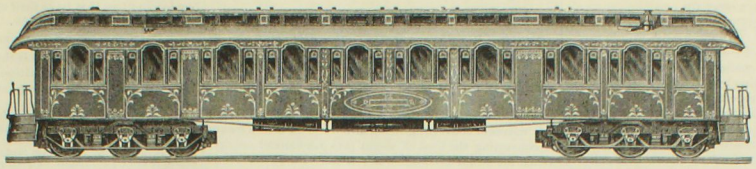
NATIONAL CAR AND LOCOMOTIVE BUILDER.



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Miscellaneous Items.

It is stated that the Westinghouse Air Brake Co. contemplates the erection of extensive works for supplying its Western trade at Rock Island, Ill.

From the first day of January to the first day of July this year, the Baldwin Locomotive Works have turned out 319 locomotives.

It is stated that the New York, New Haven & Hartford is in the market for 100 passenger cars, 20 drawing-room coaches and six anthracite burning locomotives.

The Bradley Car Works, at Worcester, Mass., have recently completed two round-roof passenger cars for the Providence, Warren & Bristol road.

The Indianapolis Car Works are now working 700 men, the largest force in its history. It will soon commence work on a contract for 1,800 cars for the Atchison, Topeka & Santa Fe.

The Martin Anti-Fire Car Heating Co. is said to have closed a contract with the New York Central for the equipment of its cars with the Martin system. The contract covers the main line and all leased lines. Work is to be begun at once.

The Baltimore & Ohio has carried the Staten Island outworks at last, and nothing remains to be done but to bridge the Kill Von Kull to effect an entrance into New York. The fight has been a lively one and somewhat prolonged, but the besiegers were sure to win in the end.

The Cooke Locomotive Works, at Paterson, N. J., are preparing to build ten rotary steam snow-shovels, two for the Union Pacific, four for the Northern Pacific, one for the Colorado Midland, one for the Oregon Railway & Navigation Co., one for the Central Pacific, and one for sale.

The Iron Car Company, of New York, whose works are located at Huntingdon, Pa., are about to let an enormous contract for materials to be used in the construction of 2,500 tube-iron freight cars, to carry 30 tons. There will be needed over 2,500,000 feet of oak and 2,500,000 feet of Georgia pine lumber.

Mr. W. T. Smith, master mechanic of the Chesapeake & Ohio shops at Huntington, W. Va., has just completed a new steel boiler 26 feet long and 61¼ inches in diameter. The boiler is double riveted, and is provided with concave flue-heads, a new feature, which is claimed to be an improvement, and a certain preventive of leaky flues.

The Boston & Providence road has completed plans for the new Bussey bridge to take the place of the one whose giving way was the cause of the terrible disaster on that road a few months ago. The new structure will be wide and massive enough to admit of four tracks, should it ever be desirable to run that many across it. Work on its construction will soon be commenced.

No wonder railways don't pay! The country must fill up better before ever they will do so. A case in point: A resident of this city "took a run out West" last autumn, and had occasion to go over a line of about 75 miles in length, which had but two trains each way per day. Himself and one other were the sole occupants of the solitary passenger car during the entire journey. One of them was traveling on a pass and the other had a thousand-mile ticket.

According to the report of the New York Railroad Commissioners for the year ending Sept. 30, 1886, there were then on the railroad lines within the State 2,415 iron bridges, with an average length of 97 feet, and 1,182 wooden bridges (exclusive of trestles), with an average length of 76 feet. The actual number of both kinds is, doubtless, considerably more than these figures indicate, as some roads seem to have made no return of bridges, while others have omitted to report many of the smaller ones.

The Fall River boat train on the Old Colony road has consisted all summer of from 11 to 15 cars. The cars average 25 tons each in weight. Mr. Lauder, the superintendent of rolling stock, had one of the 60-foot drawing room cars on the scales lately, and it weighed 58,000 pounds empty. The locomotive illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER in March last, has, without any help, pulled this train of 13 cars the whole run of 50 miles, making three stops, in 1 hour and 17 minutes.

Mr. Warren H. Craig, of Lawrence, Mass., has obtained a patent on an improved lubricator for locomotives. The device consists of a sight-feed lubricator having its two sight-feed glass chambers or tubes arranged at one side only of, and on a level or in the same horizontal plane with, the oil reservoir; and also having its oil educts leading from it to the steam chest arranged to extend in opposite direction from the reservoir. In short, an improvement intended to make one oil cup feed oil to both steam chests.

Messrs. Hugh & John Reid, from the Hyde Park Locomotive Works, Glasgow, Scotland, have been making a hurried visit to America, and seeing as many of our rail. road shops and locomotive building shops as they possibly could in the course of a running trip. They visited most of the locomotive works and a great many of the larger cities, extending their tour to California, and on return taking in the leading places in Canada. They considered themselves exceedingly well treated at the various points visited, and were refused admittance into only one mechanical establishment.

The huge Wisconsin Central ore dock at Ashland, Wis., the largest in the world, is now complete. It rests on 6,700 pine piles, which run down from 18 to 22 feet below bottom. The total dock length is 3,100 feet, width 42 feet, and height above water line 46 feet. In the superstructure 5,000,000 feet of lumber, mainly pine, was used, 425,000 feet of white oak, 200,000 feet of hard maple, and thousands of feet of handsome bird's-eye. Three-inch oak plank, 18 and 20 inches wide and perfectly clear, was frequently seen. The total cost of the work is over $300,000.

Train robbers on the Philadelphia & Reading road have invented a new way of gaining access to freight cars. On the night of Aug. 13 nearly $1,000 worth of merchandise were stolen from a car of a moving train between Pottstown and Reading, Pa. The men, it was afterwards learned, boarded the train at Phœnixville and one of their number was lowered down the side of the car by means of a rope. He easily succeeded in breaking the lock and opening the door. His confederates followed his example and they bound seventeen boxes of wearing apparel, hosiery, jewelry, etc., in one big bundle and threw it from the car, from which they then jumped.

The Southern Pacific Company has completed contracts for new cars and coaches, which will require an outlay of $756,000. The Pullman works will build 29 sleeping cars. Dayton, O., works will build 28 first-class coaches at a cost of $4,500 per car. Another firm in Dayton, together with one in Richmond, Va., is to construct for the company 300 twenty-five-ton flat cars, and 300 box cars of the same capacity. The former will cost $235,000 and the latter $180,000. When the new sleeping cars are completed the company will have in use 80 west of El Paso, and 17,000 freight cars on the whole system.

The number of persons killed and injured on the steam roads of the State of New York during the year ending September 30, 1886, as reported by the Board of Railroad Commissioners, was as follows: Killed 503, injured 1,132. Of the killed, 30 were passengers, 159 were employés, and 314 are classed as "others." This is an increase of 92 over the number killed during the previous year, but, so far as the causes were ascertained, the increase was not due to defective construction or imperfect rules or discipline, but rather to unpreventable causes arising from misconduct or carelessness. The increase in the number injured was only two. The most serious cause of death to employés was walking or being on the track. Next to this was the falling from cars and engines, and the third most prolific cause was the handling of couplers.

The Davenport (Iowa) papers worked up a fine sensation the other day, and worked it for a good deal more than it was worth. They announced that a diabolical attempt had been made by human fiends, or train robbers, to precipitate a train on the Chicago, Rock Island & Pacific Railway into the Iowa River. It was reported and telegraphed all over the country, that the fastenings of a rail close to a high bridge that spans the river had been removed, and that a horrible catastrophe was prevented by the heroic coolness of the engineer of the passenger train, who, seeing the danger, pulled his throttle wide open, and made the train jump over the opening. The base on which this visionary fabric was worked was the discovery by the track inspector that the splices at both ends of a rail near the bridge mentioned were loose. There was no indication in the world that the thing had been tampered with; but a reporter, hungry for news, heard about it, and his fertile imagination was equal to the occasion.

Vestibule Cars.

The *Berkshire County Eagle*, of Pittsfield, Mass., has the following concerning a "continuous car" in use in New England 25 or 30 years ago, giving facts which will be readily recalled by the old railroad men of that section.

The method of supplying cars with pure air free from dust was put in practice on the Housatonic Railroad fully thirty years ago. It was first invented by Charles Waterbury, since deceased, who was superintendent of the Naugatuck road, and it was used on that road, and soon afterwards introduced on the Housatonic by the late Charles Hunt, of Falls Village, president of the road. Mr. H. L. Plumb, now of Maplewood, was at the time a conductor on the road, and thus describes the arrangement in use about 1858–59. There was a sort of bellows made of heavy canvas for connecting the cars with bows of wood, which were fastened together with thumb screws. The doors at the ends of the cars were kept constantly open, while there were doors on each side of the bellows at the steps, for entering or leaving the train. On each side of the tender there was a wind-catcher, open to the front, about ten inches wide and two or three feet high, and at the rear of the tender there was another bellows arrangement which conducted the air to an air tube over the top of the baggage car, and at the rear of that it was admitted to the passenger cars. It was the perfection of railroad traveling, as the draft of air through the train was perfectly free from dust, and could be regulated as to quantity. When the train stopped, however, it was sometimes very close and hot, until in motion again. The cars were often of unequal height, and with wide spaces between, on account of the link couplings then in use, which made the use of the system somewhat difficult, so that it was finally abandoned, after being used for a couple of years.

Railroad Operation in the State of New York.

The following interesting statistics of operations and traffic of the steam surface railroads in the State of New York for the year ending Sept. 30, 1886, are contained in the report of the Board of Railroad Commissioners:

Through passengers carried	4,532,750
Local passengers carried	76,930,959
Tons of through freight carried	38,491,203
Tons of local freight carried	44,954,108
Passenger train mileage	35,492,991
Freight train mileage	53,626,948
Other train mileage	22,143,483
Number of passengers per train	52
Miles each passenger was hauled	22.47
Tons of freight per train	198.43
Passenger earnings per mile (cents)	2.31
Passenger expenses per mile (cents)	1.46
Passenger profit per mile (cents)	0.85
Freight earnings per ton per mile (cents)	0.7787
Freight expenses per ton per mile (cents)	0.4942
Freight profit per ton per mile (cents)	0.2845
Average No. of employés during year	80,873
No. passengers carried for each one killed	2,382,124
No. of locomotives, 8 drivers	402
No. of locomotives, 6 drivers	717
No. of locomotives, 4 drivers	2,853
Total No. of locomotives	3,972
Cars, first-class passenger	2,841
Cars, second-class passenger	640
Cars, baggage, mail and express	1,005
Total No. passenger train cars	4,486
Total No. freight train cars	148,120
Miles of road in the State	7,342
Miles of track in the State	12,035

Steam and Motive Power.

BY ANGUS SINCLAIR.

(*Continued from page* 107.)

LARGE CYLINDERS.

In the excellent report made to the American Railway Master Mechanics' Association by the committee appointed to investigate the best "Proportion of Locomotive Cylinders," a sentence reads: "Should extreme economy in fuel and water consumption be considered imperative and of greater importance than additional cost of superheaters and steam-jacketed cylinders, and maintenance of same, a considerable increase of cylinder power would be admissible, so as to allow the average work to be performed with a correspondingly earlier cut-off and greater ratio of expansion." Too much cylinder capacity for the boiler and for the weight on drivers has been the weak feature of American locomotive design, and the master mechanics are everywhere coming to realize the increased expense of operating that arises from this cause, so it was not surprising that the portion of the report quoted elicited general dissent. Yet the theory advocated undoubtedly contains the principles of sound steam engineering, although they have met with almost uniform failure when applied to locomotive practice. With stationary engine and marine engine work, the practice has been very successively followed of using large cylinders that would admit of early cut off and large ratio of expansion while performing the necessary work, the tendency to loss from condensation being restrained by steam jacketing and superheating.

Many engineers and inventors have insisted that a practice which results in valuable saving of fuel in the case of stationary and marine engines ought to be applicable to locomotives, hence the many efforts to provide valve motion that would give a prompt opening and closure of steam ports, and permit steam to be put into the cylinders of locomotives more quickly than is possible with the slow valve movement given by the link. These men reason that if the valve movement could be sufficiently accelerated for short points of cut-off steam would be admitted at much higher average pressure, and that four or five expansions could be obtained before the steam was released. Some good practicable valve motions have been produced embodying this idea, but there is no evidence that they effected any economy in the use of steam.

Another practice has been to provide a large cylinder in the expectation that the engine would be worked habitually with the shortest possible cut off and steam saved thereby. A case in point was a group of passenger engines with cylinders 18 by 24 inches, which were working a certain run of trains with moderate success. It was found that when the trains were heavy or the weather unfavorable, the engines had to be worked a great part of the time in the 9-inch notch, and it was all the boilers could do to provide steam. The master mechanic thought that if the cylinders were made one inch larger the engineer would seldom need to drop the reverse lever lower than the 6-inch notch, and that, consequently, the engines would do the work with greater ease and with a smaller consumption of fuel. So he had some engines built with the increased size of cylinders, but they never gave satisfaction. The best engineers on the road failed to make time with them when the nozzles were the same size as those of the other engines. When the nozzles were made smaller the engines burned more coal to do the same work as that performed by the engines with the smaller cylinders. The large cylinders had eventually to be bushed. This was a representative case, for many master mechanics have had experience of a similar kind, although they may not have bushed the cylinders.

The trouble too with large cylinders is that the engine needs more attention, and what might be called humoring, than the ordinary engineer is liable to bestow. In starting from a station the lever must be pulled back to the short cut as quickly as possible, or the steam pressure will begin dropping down. When a hard part of the road is encountered there is a great temptation to drop the links a notch, but with an over-cylindered engine this will lead to loss of boiler pressure which will not be regained till the steam is shut off. A man who properly understands the peculiarities of this kind of engine, and works her accordingly, will get the best possible work out of the machine, and in his hands she may prove economical, but an engine that can not be successfully operated by ordinary engineers is not adapted for common train service.

DIFFICULTY OF IMPROVING STEAM DISTRIBUTION IN LOCOMOTIVE CYLINDERS.

When locomotives are designed with a valve motion specially adapted for cutting off steam earlier than 25 per cent. of the stroke, the leading obstacle to their success economically appears to be excessive cylinder condensation. This subject has received surprisingly small attention from railroad mechanical men, and its importance is rarely realized, or there would be work done to keep the cylinders protected from cooling influences.

The economy of cutting off steam very early in the stroke is, to a great extent, dependent upon the pressure carried. With very high initial pressure it may be possible to cut off earlier than 25 per cent. of the stroke and obtain good results without the use of steam jacketed cylinders, but under ordinary pressures a cut off much short of 25 per cent. of the stroke produces, as Clark says, expansive working that is expensive working.

CYLINDER CONDENSATION.

Saturated steam is constantly on the dew point and on the least portion of the heat of vaporization being taken away, a corresponding portion of the steam falls into water just as it acts on a large scale in a condenser. In fact, all cylinders act as condensers to a greater or less extent, and some of them appear to be more efficient as a means of converting steam into water than as a means of converting the heat of steam into mechanical energy. When the steam becomes water it loses its power to do mechanical work in the cylinder, therefore the percentage of steam that condenses in the cylinder represents so much loss of power.

In the Newcomen engines, the earliest form of steam engines used for industrial purposes, the steam was condensed in the cylinder to create a vacuum, the cooling being done by injection of cold water. With an engine worked on this system there were enormous losses of heat through the cylinder having to be re-heated to the temperature of the steam each stroke. When James Watt first began experimenting with an engine of this type, he found that it took about four times the quantity of steam for each stroke that was necessary to fill the cylinder, three volumes having been wasted in heating up the metal of the cylinders. This led to his invention of the separate condenser, which avoided the necessity for cooling the cylinder to the temperature of the condensing water.

The Newcomen engine presented an example of extreme waste from cylinder condensation. The heat losses occurring in cylinders not cooled down intentionally are much smaller than the waste inseparable from the earliest style of condensing engine, but they are, nevertheless, still very serious in many modern steam engines. The leading physicists and engineers who have devoted much attention to investigating the extent of cylinder condensation have shown that in engines without steam jacketed cylinders, cutting off steam earlier than half stroke, the loss from cylinder condensation is seldom less than 20 per cent. of the whole steam that enters the cylinders and that it often rises to 50 per cent. and upwards.

The leading investigators in this line of research have been Americans, Chief Engineer Isherwood, of the United States Navy, making the most important discoveries. Mr. Charles E. Emery, M. E., has also thrown valuable light upon the subject. In the course of experiments carried out to ascertain the extent of cylinder condensation, Mr. Emery constructed two cylinders exactly the same size, one being of iron the other of glass. When put in turn in the condition of a steam engine cylinder, it was found that the iron cylinder used fully twice as much steam as the glass one, the great loss occurring with the iron cylinder being due to its tendency to conduct away the heat.

In the ordinary working of the steam engine, cutting off at 25 per cent. of the stroke, the steam from the boiler at say 145 pounds absolute pressure, having therefore a temperature of 356 degrees Fah., passes into a comparatively cool cylinder and the iron of the cylinder absorbs heat till its temperature is equal to that of the steam. The portion of the steam robbed of its heat becomes spray, and helps to dampen the steam filling the cylinder. When the steam is cut off and expansion goes on a portion of the heat of the steam is transformed into mechanical energy, and a proportional amount of condensation takes place. By the time release is reached the pressure of steam has fallen to about 40 pounds absolute, and the temperature to 267 degrees Fah. The steam which became water under the heavy pressure at the beginning of the stroke is now ready, owing to release of pressure, to flush back into steam, and it re-evaporates at the moment it is passing out of the cylinder, carrying away with it a great deal of heat extracted from the walls of the cylinder. According to Tyndall, the aqueous vapor of the atmosphere has seventy times the absorptive power of dry air. This same attribute extends evidently in a like proportion to wet steam, which draws heat from the metal of the cylinder very freely, and carries it away to the atmosphere, leaving the metal to be reheated by the next induction of steam. During the return stroke a portion of the steam left in the cylinder is compressed after the valve closes, and the mechanical work done by the piston in squeezing the steam into contracted space is converted into heat and helps to raise the temperature of the cylinder to approach that of the incoming steam. Nearly all the experiments carried out to ascertain the extent of cylinder condensation have shown that compression is not only a convenient means of cushioning the reciprocating parts, but it contributes a very important element to economy of steam by filling the clearance spaces and helping to re-heat the cylinder. There is good reason for believing that the men who have labored to increase the capacity of the cylinder by producing an improved valve motion that would materially reduce compression, have lost more in steam than they gained in power by the change.

The serious losses that occur in the steam engine cylinder through condensation have been well known to scientific men for years, yet the men who are responsible for leaving the locomotive cylinders badly exposed to refrigerating influences are very slow to realize the extent of the waste caused thereby. Steam jacketing is impracticable for the locomotive, but good lagging is not, and there are few locomotives that have their cylinders so well protected by this means as they might be.

ISHERWOOD ON CYLINDER CONDENSATION

Chief Engineer Isherwood is the best living authority on the effect cylinder condensation exerts upon the economical operation of the steam engine, and he writes upon the subject as follows :

"The discovery that the cylinder of a steam engine acted alternately as a condenser and as a boiler, condensing a portion of the entering steam during its admission and revaporizing the resulting water of condensation during the period of expansion and during the exhaust stroke, which phenomena were caused wholly by the interaction of the metal of the cylinder, and would not have happened had the cylinder been constructed of a material which neither received nor imparted heat, was made a great many years ago by the writer, and stated and used in his published professional writings. No one contested the discovery, or even used it, until quite lately ; in fact, it was not for a long time believed. The discovery was made and proven in the only way possible, namely, by weighing the water fed into the boiler, and ascertaining, by means of the indicator, the weight of steam present as such in the cylinder at the point of cutting off and at the end of the stroke of the piston, adding to the last quantity the weight of steam condensed in the cylinder to furnish the heat transmuted into the power developed by the expanding steam, the latter obtained also by means of the indicator. The difference between the weight of water fed into the boiler and the weight of steam accounted for by the indicator at the above two points of the stroke of the piston is the weight of steam condensed in the cylinder at those points by the interaction of the metal of which it is made.

"No investigator other than the writer ever made experiments in this manner for a great many years after 1859, nor thought of ascertaining by measurement the difference of the weight of steam as given by the indicator and by the weight of water fed into the boiler, nor dreamed of attributing that difference to the interaction of the metal of the cylinder. The only cylinder condensation suspected was that which is obviously due to external radiation, and is a mere trifle under the conditions of good practice. This is the crucial point, and before any other experimenter can substantiate a claim to the discovery of cylinder condensation by the interaction of the metal of the cylinder, he must show the previous publication of an experiment in which that condensation is deduced from the comparison of the weight of steam accounted for by an indicator and the weight of water fed into the boiler. The writer is well acquainted with the literature of his profession, and is very confident that no such publication can be produced.

"The writer made and published many such experiments in all their details on engines of different sizes and designs, deducing from them and for the first time, what may be called the *Physiology* of the steam engine, as distinguished from an abstract mathematical conception of its theory, which has been exclusively in vogue before his work was given to the public, and still is largely accepted by professors ; but his results, though now generally adopted by engineers, were for a great many years ignored, or rather silently disbelieved by all, because contrary to the then received ideas on the subject, without the great underlying fact of cylinder condensation due to the interaction of the metal of the cylinder, there can be no correct theory of the steam engine ; for without it there can not be understood how the economy of the power, other things equal, is so greatly affected by mere size of cylinder as it is, becoming less as the size of the cylinder becomes less; how, other things equal, the economy of the power is affected by the reciprocating speed of the piston, becoming less as that speed becomes slower; how the gain theoretically due to greater measures of expansion for the steam is not practically realized, the cylinder condensation increasing with increased measures of expansion, until the increased loss of steam by this condensation soon equals the gain due to the increased measure of expansion. Steam condensation in the cylinder by the interaction of its metal explains, and furnishes the only explanation of the economy to be derived from using superheated steam, from using steam jackets for the cylinders, and from compounding the cylinders.

"The writer very early pointed out how quickly the limit of economy was reached by the expansion of saturated steam in a single cylinder, gave the reason therefor, supported it by abundant experimental proofs, and saw it rejected by every one for many years, and by many even now. He not only stated the facts qualitatively, but he experimentally gave the quantitative determinations for a great variety of cases. All that incredulity had to do was to repeat his experiments, but it was found much easier and more agree able to ignore them. In the few test repetitions that have been made, as in the present experiments, the writer's results were always reobtained, but the experimenters seemed to lack faith in their own work, and to think that some incomprehensible error had produced them.

"No theory of the steam engine can have any value which is not based on the great fact of cylinder condensation by the interaction of the metal, and on the variations in the quantity of that condensation due to different conditions. Nothing else will explain the results of steam engineering, and here, as everywhere in industrial art, the properties of matter must be considered in connection with abstract laws if practical results are to be correctly predicted, or even understood."

From Fireman to Engineer.

A correspondent sends us the following description of how firemen on the Illinois Central Railroad graduate to the right-hand side of the locomotive :

"This company has established rules governing this part of their service. I will briefly explain a portion of them. When a young man wishes to get a position as fireman, expecting of course to become an engineer in time, he must bring reference as to character. In addition to this he must show that he has had a good common school training. If he proves this by a practical illustration in presence of those desiring his services, then he

is taken on trial. If he is the kind of person they want he remains two years. At the end of that time he may make application in writing for examination to become an engineer. If the company are in need of engineers his request is granted. He then appears before the examiners, consisting of the head of the mechanical department and his assistants. He must know every portion of the machine he expects to take charge of, the constitution of the boiler in detail, the breaking strain of every bolt, the nature of steam and how to set valves. In fact, he must have a thorough knowledge of his engine; and to make himself proficient to pass this ordeal, he is compelled to study diligently during the most of his leisure hours. If he is found capable in the mechanical department he is then turned over to the transportation department, where he undergoes an examination pertaining to rules, regulations, etc., governing the running of trains. If perfect in the latter, he is put in charge of a locomotive, but only on trial. If at the end of a specified time he gives satisfaction he is then given a certificate as engineer."

Performance of a Small Old-Time Locomotive.

There are few roads in the country which have changed from light to heavy locomotives within the last few years, where the complaint is not frequently heard that the heavy engines are much less efficient for their inches than were the smaller locomotives that proceeded them. The complaints in this respect are much stronger against the new types of large passenger engines than against those used in freight service. Some allowance in cases of this kind must be made for the conservative tendencies of locomotive men, but when these are taken into account, and the disposition so prevalent to magnify the value of old-time machinery is considered, it will be found that the complaints about big engines being deficient in comparative efficiency have some foundation in fact. The performance sheets and train records on many roads substantiate this.

A small steam engine must necessarily be more efficient than a large one, but large engines are often imperfect through being defectively proportioned, and there is good reason for believing that many modern locomotives do less work than they ought to, through the steam passages being too small.

We recently had the opportunity of examining a series of indicator diagrams taken from one of these old-time smart and efficient little locomotives belonging to the Pittsburgh, Cincinnati & St. Louis Railway, and through the kindness of Mr. Edward E. Wall, superintendent of motive power of the road, we reproduce a few of them for the benefit of the readers of the NATIONAL CAR AND LOCOMOTIVE BUILDER. The letter from Mr. Wall which accompanied the diagrams, gives interesting particulars about the engines. He writes:

"In accordance with your request, I inclose herewith some representative indicator diagrams taken from one of our Little Miami Division passenger engines. There is nothing at all remarkable in these cards, and our only desire in taking them was to preserve for reference the indicated performance of an old class of engines which in a short time will become obsolete.

"This class of engines, prior to the introduction of our heavy passenger engines on that division, was doing the heaviest express-train work, and obtained considerable fame by the success with which they did it in this service. The cards do not indicate any extraordinary distribution of steam, and the simple conclusion may be reached that a small engine is capable of doing an extraordinary amount of work, greater, comparatively, than the larger ones, all things considered. These engines were built at our Little Miami shops, by Mr. J. H. Setchel, at the time he was master mechanic of that division, and are an improvement on an earlier type of engine somewhat similar in construction.

"The train hauled while taking the cards marked 2 to 21 consisted of two baggage cars, three coaches and one sleeper, altogether weighing about 267,000 pounds. With those marked from 24 to 41, the train consisted of two coaches less, and weighed about 176,000 pounds. The following are the dimensions of the engine:

Weight on driver	44,160 pounds.
Weight on truck	26,500 "
Diameter of cylinders	16 inches.
Stroke of cylinders	22 "
Size of drivers	60 "
Dimensions of steam ports	15 × 1¼ "
Dimensions of exhaust ports	15 × 2½ "
Lap of valve	¾ inch.
Lead of valve	1/16 "
Exhaust lap	1/32 "
Throw of eccentric	4⅜ inches.
Travel of valve	5 "
Nozzles round	3 "

An examination of the diagrams will show that they give a fair representation of the work the engine will do under all conditions of service, slow heavy pulling, medium speed and high speed. The following are the leading data respecting each diagram:

No. 1. Speed, 70 revolutions per minute; boiler pressure, 110 pounds; cut-off, 17⅞ inches.

No. 2. Speed, 110 revolutions per minute; boiler pressure, 120 pounds; cut-off, 15⅝ inches.

No. 3 Speed, 144 revolutions per minute; boiler pressure, 120 pounds; cut-off, 13⅛ inches.

No. 4. Speed, 192 revolutions per minute; boiler pressure, 120 pounds; cut-off, 11½ inches.

No. 5. Speed, 190 revolutions per minute; boiler pressure, 110 pounds; cut-off, 11½ inches.

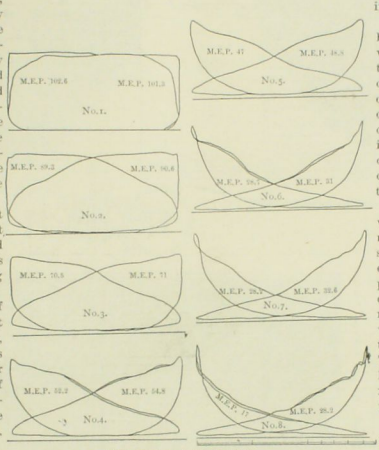
No. 6. Speed, 282 revolutions per minute; boiler pressure, 125 pounds; cut-off, 8⅛ inches.

No. 7. Speed, 320 revolutions per minute; boiler pressure, 125 pounds; cut-off, 8⅛ inches.

No. 8. Speed, 360 revolutions per minute; boiler pressure, 120 pounds; cut-off, 8¼ inches.

At slow speeds, with the steam following the piston through the greater portion of the stroke, the average admission is good, but it is not extraordinarily high. The average run of good modern locomotives will show as high a mean effective pressure when the revolutions are under 100 per minute. Where this engine makes a particularly good comparative record, is when working with high piston speed. While running at a speed of 57 miles an hour, as represented in diagram No. 7, and with a piston speed of 1,173 feet per minute, an average mean effective cylinder pressure of 30.4 pounds is maintained, and a tractive power of 2,853 pounds is developed, less the friction of the engine. When the latter reduction is made, the engine was probably capable of keeping the train, weighing 267,000 pounds, going at the speed named on level track. The total horse-power developed was 434, which was fairly high for a small engine.

The next diagram is rather phenomenal for an eight-wheel locomotive with drivers five feet in diameter. It is not many years ago since gentlemen with some standing in the railroad engineering world, kept up a prolonged controversy in the railroad journals, trying to show that it was impossible for an engine with a five-foot wheel to run 60 miles an hour, and here we have a record of one running 70 miles an hour.



Scale 80 pounds to the inch.

The free steam admission at high speed, and the small amount of back pressure show that the engine had ample passages for giving unobstructed admission and release. In this respect, the engine shows better than most modern locomotives. In the days when the short port heresy was rife among master mechanics, we often heard it asserted that there was no difficulty in getting steam into the cylinders fast enough; the difficulty was in getting it out quickly enough to avoid back pressure. That statement, like some other sophistries of the time, was partly fact and partly fiction. For moderate speed the ports of ordinary locomotives were large enough, but high speed is the severe test, and for that the largest ports gave a too restricted opening. This Little Miami locomotive was so exceptionally well proportioned as to make the class of engine famous, and we are not acquainted with any modern locomotives that have the same opportunity to be smart and efficient for high speed. Ignoring clearance, the Little Miami engines had 4,422 cubic inches in each cylinder, and 1875 square inches area of steam port, or 1 square inch of steam opening for every 235 cubic inches to be filled. An ordinary 18 × 24 inch locomotive has 6,608 cubic inches in each cylinder. We made some investigation lately into the working of an engine of this class designed for fast passenger service, and the steam ports were 16 × 1⅛ inch. This gave 18 square inches as the total steam port opening, and only provided 1 square inch of port opening for 366 cubic inches to be filled. Great as this difference is, it has been shown that the relatively smaller port is sufficient to admit the required steam freely enough with low piston speed, but at high piston velocities and short opening of valve the case is different.

Suppose we take the two engines when they are each using 8 inches of steam, that is, cutting off at 8 inches of the stroke. With that short valve travel the port opening will not exceed ⅜ inch. The small engine has 1,608 cubic inches of cylinder to fill, and the total port opening will be 5⅜ square inches, or 285 cubic inches for each square inch of opening, or 21 per cent. more relative space than had to be filled by the full port opening. That looks bad, but the supply of steam to the large cylinder at the short cut-off is done under more adverse conditions still. The space to be filled is 20,36 cubic inches, and the total steam port opening is 6 square inches, or 1 square inch for every 339 cubic inches. With the large engine the port will not remain open any longer than with the small one, and if the boiler pressure is the same the steam velocity will be equal, so it is absolutely certain that the mean effective cylinder pressure must be lower in the large modern locomotive than in the small engine of the type that is called obsolete. The large engine has 19 per cent. more cylinder space to fill than the small one per inch of port opening, and that may safely be regarded as a fair percentage of the difference between the efficiency of the two classes of engines when the dimensions are the same as those figured on. To make the large engine as efficient as the small one for short points of cut-off, the steam ports would need to be 20 inches long.

Night Work in Machine Shops.

After a great deal of discussion on the subject of night-work, employers have not reached any uniform conclusion, apparently because they have allowed their desires to bias all their observations. Night work, or that which has to be performed by lamp light, is of a poor quality because men cannot see to do good work by any light which has yet been used for the purpose of shop illumination. Perhaps a better form of the statement would be to say that such work is not as good in quality as that done by daylight. How great a falling off there is likely to be, any one may see by trying to do any little delicate piece of metal work in the evening and again in the day time.

The following conclusions may be set down as facts, having been deduced from a long experience. Night work does not pay for the gas or oil used in lighting up the shop. The work done at night is not satisfactory in quality as compared with that done by daylight. The quantity of work done after lamps are lighted is insignificant as compared with the amount of time taken. In other words, loafing begins at dark. This is not always intentional, but it takes place all the same. Night shifts coming on after the lamps are lighted do but little work as compared with what the same shifts could do in the day time.

In a shop where small machinery of a regular character was made, it was the habit not to light up in the winter months, but close when it became dark. Winter and summer the men were paid for nine hours' work, the early closing shortening the day's work and not the day's pay. At the end of the year the manager took an account of the quantity of work done and found that he had not only saved the expense of oil and lamps, but that the work done in December, January and February exceeded that done in June, July and August by eight per cent. The number of men, character of work and all details having been the same for both periods, he naturally reached the conclusion that it did not pay to work overtime or even full time in winter.

While the electric light does something towards sufficiently lighting the shop, it is lacking in several of the most important requisites for shop use. Its bluish color is bad and does not properly illuminate cast or wrought iron. Oil is cheap, but does not give light enough, while gas is costly. It seems best, therefore, to obey the command, "work while it is day, for the night cometh when no man can work."—*Mechanical News.*

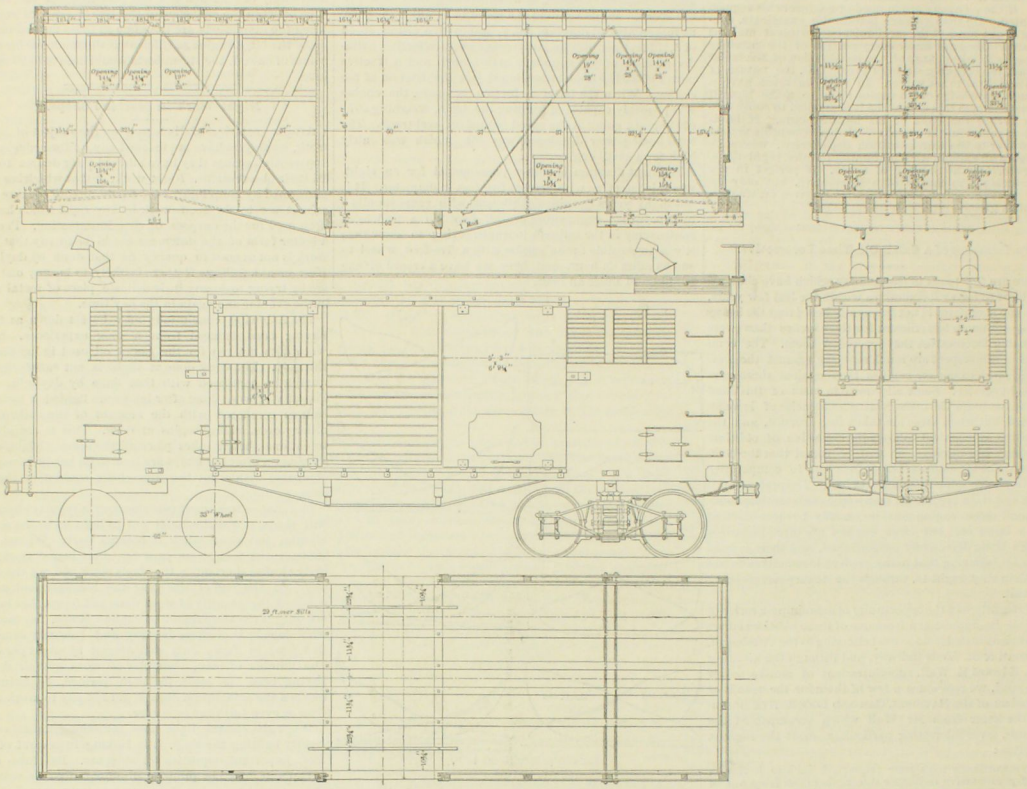
The Colorado Midland Railway.

This road is now completed and in operation from Colorado Springs to Buena Vista, a distance of 101 miles. The track is said to be one of the finest in the country. The Pullman Company is building the entire car equipment, which includes drawing-room and sleeping cars, first and second class day coaches, combination baggage and passenger cars, suburban cars, baggage and mail and baggage and express cars. The drawing-room cars and sleepers are similar in their construction to the Pullman vestibule cars, except that the exterior vestibule is omitted, but can be added should it be desirable. They are 60 ft. 9 in. long by 9 ft. 8 in. wide over sills. The interiors are finished in mahogany, the ceilings are of white wood richly decorated. The seats are low, with high backs, and are upholstered in maroon and old gold plush. The windows are 24 in. wide by 34 in. high, and have double combination Gothic mahogany sashes. The cars run on six-wheel trucks, and the wheels are either the Allen paper or the Paige steel tired.

The first-class day coaches are 48 ft. long and 6 ft. 6 in. high from top of sills to plate. The inside finish is mahogany, and there are 16 windows on each side. Each car seats 55 persons, and has two saloons, two marble wash-stands, and a handsome smoking-room finished in mahogany. The second-class coaches are of the same dimensions, but are finished in oak and cherry. The suburban cars are 50 ft. long and have rattan seats arranged like those in the cars of the New York elevated roads. These, and the first and second-class coaches, have 4-wheel trucks, and the axles of all the trucks are of Otis steel. Baker heaters, placed in closets lined with incombustible material are used, and all the cars have Westinghouse automatic brakes and Miller platforms. A portion of the drawing-room and sleeping cars have already been delivered, and the rest of the order will soon be completed

The Pennsylvania Railroad Co., it is said, has finally concluded that however successfully it can run the railroad, it cannot keep a hotel. Its hotels and restaurants have been managed by the Keystone Hotel Co., a subordinate institution, and the loss has been constant, and heavy at times, although it has been more than made up by the increased traffic on the railroad.

FRUIT CAR—ILLINOIS CENTRAL RAILROAD.



The car represented in the cuts is designed especially for the Southern fruit traffic of the Illinois Central road. Much of this class of freight has heretofore been carried in ordinary box and stock cars, the former affording insufficient ventilation and the latter insufficient protection. These difficulties are obviated in the fruit car, as shown, which has nine openings in each side and five in each end, besides the usual side and end doors. Each of these openings is fitted with a grating of ½ inch iron rods, and covered with wire netting 3½ inch mesh, No. 13 wire. The upper openings are also fitted with additional solid inside sliding doors, and the lower ones with outside doors which are kept open or closed as may be found necessary to provide ventilation and protect the fruit against the weather. The two ventilators in the roof are always open.

These cars have proved very seviceable in the transportation of fruit. They also have Allen's patent grain doors, and can be used for carrying grain.

Railway Disinfectants.

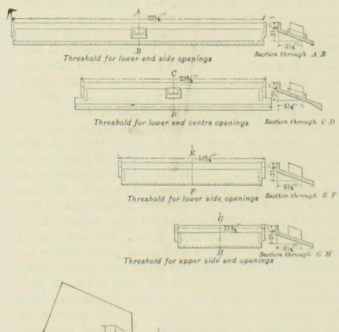
The following are extracts from a paper on the above subject submitted to the Master Mechanics' Association by Mr. G. C. W. Belcher:

"Even at the risk of offending the American Association of Railway Chemists, I must enter a protest against the constant use of very poisonous materials, simply for deodorizing purposes. The recommendation of zinc-chloride as a deodorizer seems to me ill-advised. It is certainly inferior to other articles that are less dangerous and less expensive. For purely germicidal purposes, no fairly well posted man would presume to question the authoritative position of mercuric bichloride. The strength of the solution, as recommended by the Railway Chemists' Association, viz.: one in two thousand, is conservative and open to criticism.

"I contend, however, that the deodorizing feature should form the basis of, and the germicidal feature the accessory to, an article which is in every day use, which is liable to be handled by ignorant employés, and the demand for which does not always depend upon the existence of a virulent and contagious epidemic.

"With reference to the deodorization and disinfection of the basins in railway toilet rooms, I can hardly say much without appearing in the light of an advertising agent. The problem is difficult and has been well studied by many minds.

"Among devices which are at best useless I mention such as a lump of charcoal, which soaks up the artificial water, thereby bringing it into a contact with the air, and allowing it to ferment and become a nuisance; a piece o. camphor, which certainly dissolves very slowly, bu


Threshold for lower end side openings
Section through A B
Threshold for lower end centre openings
Section through C D
Threshold for lower side openings
Section through E F
Threshold for upper side and openings
Section through G H
Section through S T

merely covers a bad odor by a pungent perfume and adds to the misery of the temporary occupant of the room; and carbolic acid (either incorporated with soap or in some crystalline form) which is open to the same objection. Neither camphor nor carbolic acid neutralize ammoniacal odors in the slightest degree, as you can determine by experiment.

"The best device would be a very abundant supply of ice or ice water, something equivalent to a water tank upon which no taxes were paid. But this is not always possible and a makeshift may be necessary.

"For neutralizing odors under these circumstances, an ideal cake should contain 100 per cent. of active deodorizers and should dissolve without disintegration and not more rapidly than is required by the work to be done. A cake made by the solution of soap or similar substances can hardly contain more than 20 or 30 per cent. of deodorizing material and is comparatively worthless. By compression in a solid form a much more available product can be obtained. It is possible to manufacture a cake which contains 75 or 80 per cent. of deodorizing material, and the matrix or residue of which causes no interference with drainage, etc. This is the best result I have at present obtained, but I am working hard for the other 20 per cent.

"And now a few words for what lies beyond the present aims and objects. Two great features in railway transportation seem not to have obtained sufficient notice.

"Firstly—Emigrant cars. They deserve more care than at present received. It may not be feasible to keep them as neat as first-class coaches, but the difference need not be so disagreeably noticeable.

"Secondly—Stock cars, to which public attention has been called by the recent circular of the Commissioner of Agriculture. The time is near at hand when, for pecuniary interests alone, all stock cars will be kept clean. Pleuro-pneumonia is an episode, a most disastrous one; but beef-handlers ought not to require any proof that the same intelligent care which is given to stock while farmed or grazed should be used for their comfort while in transportation. Steam and iron are costing us less every year. Aside from all humane feelings, beef and mutton ought not through careless waste to remain high priced."

Fibrous Steel.

The manufacture of fibrous steel is said to be making rapid progress in England, and there appears to be a likelihood of steel manufactured in this way regaining some of the prestige which the better brands of iron have taken from homogeneous steel of late years. If the fibrous steel should be shown by experience to be equal to the service of cable and rivet making, the best iron firms will be run very hard, since it will be impossible for them to compete with the steel-masters in the matter of price. The makers hold that the new metal is well adapted also for armor plates—in the manufacture of which the pile has to return to the fire so often—since the silicious coating of each fiber protects it, it is claimed, from the action of the fire, where pure iron would perish. For the same reason it might be used, it is inferred, for the bilges of ships, as to which recent experience has shown that homogeneous steel is subject to rapid oxidation.

In this country steel has been abandoned by many designers of machinery, owing to the impression that it is not so reliable as iron under all circumstances. The fibrous quality may prove sufficiently reliable to help steel to regain the shine to its tarnished character.

ETCHINGS OF ROLLING STOCK MATERIAL.

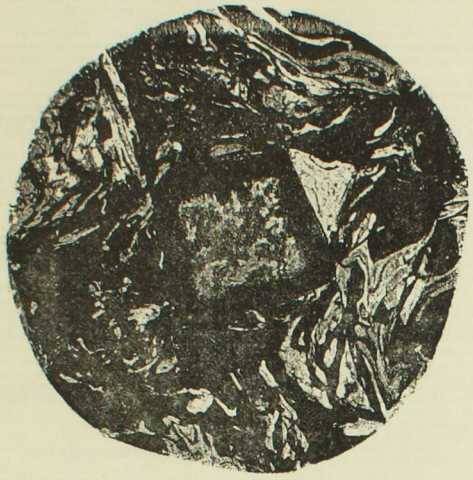


Fig. 1.

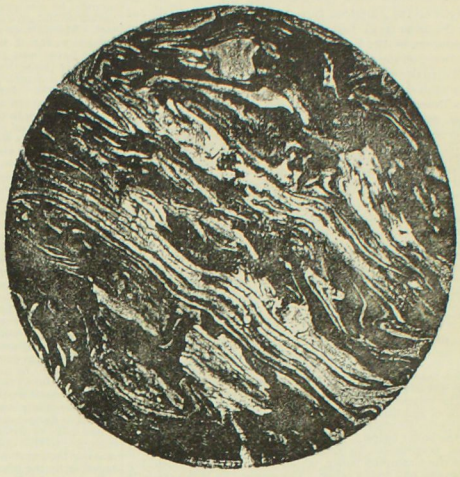


Fig. 2.

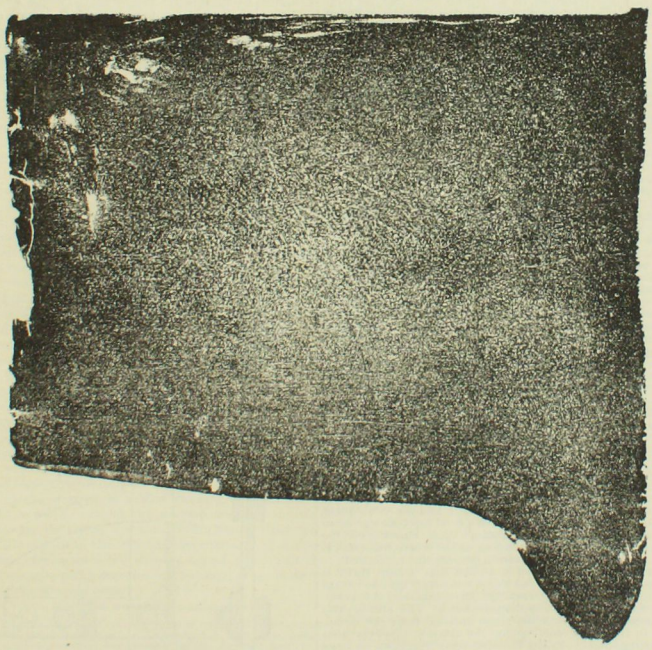


Fig. 3.

Through the kindness of the officers of the mechanical department of the Chicago, Burlington & Quincy Railroad, we are able to lay before our readers the annexed etchings, which illustrate an excellent method showing the compactness and density of metal used in rolling stock construction. The method of making the etching is to make a fairly level and smooth surface of the part of the metal to be illustrated, then subject it to the action of diluted acid, which cuts out the impurities. The surface is then carefully washed, after which it is ready for printing, and that is done with printers' ink just the same as with any other engraving. The etchings shown were taken in the laboratory connected with the C., B. & Q. shops at Aurora.

Fig. 1 is the cross section of a Master Car-Builders' freight axle, which was tested in the laboratory and proved particularly hard to break. It will be seen that the piling of the iron is very distinct, the iron is very close grained, and broke with a fine crystalline fracture. The diameter of the axle was 4¼ inches at the center, and it weighed 378 pounds. It was placed on supports three feet apart, and struck with a weight of 1,640 pounds. It was turned over after each blow. It stood 8 blows at 10 foot drop, 2 blows at 15 foot drop, 2 blows at 18 foot drop, and broke at the fourth blow at 25 foot drop.

Fig. 2 is from an axle which broke under a passenger coach. It was subjected to the test made on the other axle, but broke at the second blow with the ten foot drop. The fracture is coarsely crystalline. The open coarse grained condition of the metal can be seen from the etching.

Fig. 3 is the cross section of a locomotive tire 4½ inches thick, and was taken to see if the process would throw any light on the rapid wear of the thick tires. We think it gives very valuable testimony. It will be seen that the outside of the tire is dense, making an impression nearly black, and that it gets lighter towards the center, indicating that the steel is there less compact. In many other etchings taken from rail sections and other articles of rolled steel, it is always found that the portion coming nearest the rolls is the densest, and that the apparent porosity in the center of a piece increases in proportion to the distance it is away from the point of roll impact.

The Master Car and Locomotive Painters' Association.

The eighteenth annual convention of this Association will be held at the Grand Central Hotel, in New York, beginning on Wednesday, Sept. 14. The following subjects will be brought before the convention, each subject to be introduced by the committee to which it has been assigned:

1.—*It is generally admitted that scarcely two Samples of Japan of Different Manufacture will give like results as to Drying and Binding Qualities. Why should there be such a Variation, and can we not have a Standard of Specifications as to Drying and Binding? In what way shall such a Standard for Japan be determined?* Byron Stanbury, Union Pacific R. R., Omaha, Neb.; Alex. Campbell, Manhattan Elevated R. R., New York, N. Y.

2.—*Does the Addition of Japan to Raw Linseed Oil Retard its Drying if used in Excessive Quantities, and what Variation is there in the Drying Qualities of Japans when mixed with Raw Linseed Oil?* M. W. Stines, Barney & Smith Manufacturing Co., Dayton, Ohio; A. E. Barker, Chicago & Northwestern R. R., Chicago, Ill.; R. W. Scott, Delaware Car Works, Wilmington, Del.

3.—*What is the Maximum Amount of Japan that can be used with Safety, and the Proportion to Raw Linseed Oil?* Jos. J. Murphy, Louisville & Nashville R. R., Louisville, Ky.; H. Libby, Charles River St. Ry., Boston, Mass.; Wm. E. Hibbard, Boston & Albany R. R., Allston, Mass.

4.—*What Quantity of Oil Paint composed of Metallic Paint Linseed Oil and Japan should constitute a Good Coat to the Square Yard of Surface, Amount in Weight and also Measure?* F. S. Ball, Pennsylvania R. R., Altoona, Pa.; M. L. Sims, East Tennessee, Virginia & Georgia R. R., Atlanta, Ga.

5.—*Would it be more Economical for the Painter to Manufacture his own Japan, or continue to use that of the Manufacturer?* Geo. O. Widner, late of Lake Shore & Michigan Southern R. R., Buffalo, N. Y.; H. M. Billings, Pittsburgh, Cincinnati & St. Louis, R. R., Columbus, Ohio.

6.—*Management of the Railway Paint Shop.* E. L. Bigelow, Baltimore & Ohio R. R., Baltimore, Md.

7.—*What Constitutes the Best Priming Coat of Paint for Locomotives and Tanks?* Jno. S. Atwater, Hinckley Locomotive Works, Boston, Mass; F. M. Widner, New York, Lake Erie & Western R. R., Buffalo, N. Y.; C. C. Wood, Pennsylvania & New York R. R., Sayre, Pa.

8.—*What is the Best Method of Mixing and Grinding Car Body Colors to Insure the Greatest Durability?* Jacob Hoesly, Pennsylvania R. R., Meadow Shops, N. J.; Robt. McKeen, New York, Pennsylvania & Ohio R. R., Kent, Ohio; Jno. Rattenbury, Chicago, Rock Island & Pacific R. R., Chicago, Ill.

9.—*Causes of Iron Rusting under the Priming Coat of Paint and the Effect Rust has on Paint?* A. J. Bishop, Cleveland, Columbus, Cincinnati & Indianapolis, R. R., Delaware, O.; C. C. Young, Chicago, Rock Island & Pacific R. R., Trenton, Mo.

10.—*Is it Advisable to Paint the Inside (water space) of an Engine Tank to protect it, and what Material would you consider it best to use?* Sam'l Brown, Old Colony R. R., Boston, Mass.; E. E. Earl, Northern Pacific R. R., St. Paul, Minn.

By resolution, passed at the last convention in Chicago, each member was requested to prepare three panels, one each of Tuscan red, straw color and olive brown, according to their own formula, expose them to the weather and report results in writing at this convention.

On questions 1, 2 and 3 a regular committee has been appointed, but the advisory committee recommended that all members make practical experiments, keeping a record of them as made and report results in writing at this meeting. And in carrying out the experiments they suggested the following tests: Mix raw linseed oil and turpentine japan, varying the proportion of oil from 2 to 20 parts to 1 part japan, which would give 10 different mixtures. These to be spread on as many pieces of glass, or other non-absorbent surfaces, and submitted to a temperature of 120 degrees Fahr., noting length of time required for each to dry. The results of these tests will no doubt be highly satisfactory and much definite information obtained, and by having all the members engaged in the test, it will cover nearly all the reputable japans in the market and include many qualities of linseed oil.

Englishmen Discussing Canadian Locomotives.

We continue below the interesting discussion on the merits of the American type of locomotive, brought out by the paper read before the Institution of Mechanical Engineers, by Mr. F. R. F. Brown, of the Canadian Pacific Railway, on the "Construction of Canadian Locomotives." We give the criticism of Mr. Druitt Halpin, a well-known mechanical engineer, and the answer made thereto by Mr. Brown:

Mr. Druitt Halpin said the only American engine he had ever seen was the one shown in the Paris Exhibition of 1878, which, for design, workmanship and material, left a very great deal indeed to be desired. Among the peculiarities of the American type of engine, one of the first to attract attention was the system of trellis-work called the frame, which was, of course, a very old construction, being nothing else than the old discarded Bury frame. In the very early stages of English locomotive making that arrangement had been discarded, and it had never been reverted to in this country. What was thought of it in America seemed evident from Fig. 7, from which he inferred that even the strain from the brake-blocks when on one side only of the wheels was more than it was thought desirable to throw upon the bar-frame; and the levers and double blocks shown in Fig. 7 were therefore required for taking the strain off the frame, though no difficulty of that kind was experienced in this country with the plate frame. Another great objection to the bar frame was that it robbed the fire-box of width, and thereby led to the abnormally long fire-boxes that were such a great evil, particularly when made of steel, to which the expansion and contraction did so much harm.

The wagon-top boiler had been stated by Mr. Worsdell to be of English origin; and it was well known that originally the English fire-box was cranked up above the top of the boiler barrel. One of the best designs which had been perpetuated in English locomotives he considered was the Crampton boiler, which had simply a flush top from one end to the other. The wagon-top boiler with its rise at the back end was supposed to give the advantage of getting the regulator high up and thereby avoiding priming. But this was accomplished at the expense confessedly of nearly filling the whole barrel with water, so that the area of water surface was greatly decreased; and it seemed questionable to himself whether such a decrease of the water area would not increase the trouble it was intended to avoid. From the mention of a drooping flange or collar on the regulator pipe, it seemed evident there must be some good reason for putting the flange there. But on the Continent he had seen a much more elegant way of preventing priming; wherever a dome was to be placed on a boiler, the hole in the boiler was cut somewhat smaller than the dome, and the boiler-plate was flanged roughly downwards or inwards round the hole, not with blocks but with hammers. That plan gave a great strengthening all round the hole, and also stopped the priming most effectually. In the dome shown it appeared to him that turning the flange out, whereby the metal was necessarily thinned at the flange, and then riveting it on the boiler, made but a very poor job, notwithstanding that some sort of compensation was attempted by inserting an extra thickness of plate as a strengthening ring.

The fire-hole was described as elliptic in form, 16 inches long by 14 inches high. When made so nearly round, it was not clear to him why it should not be made truly circular, so as to get a plain simple construction.

The boiler work was stated to be all punched, which he thought in the light of present experience was low-class practice. It would also be observed that in the S. A. light engines the longitudinal seams of the boiler barrel of 52½ inches diameter were double-riveted zigzag with lap joints. But in the S. B. heavy engines, with a boiler only 2 inches larger in diameter and only 10 lbs. higher pressure, the better practicewas adopted of riveting the longitudinal seams with double-welted butt-joints. Yet further on, in the boiler of the S. D consolidation engines, with the same larger diameter of 54 inches and the same higher pressure of 160 lbs., the double riveted lap-joints were reverted to, which certainly appeared somewhat inconsistent.

The substitution of cast iron for wrought iron appeared to be largely carried out in these engines; but the smoke-box door seemed to him not a happy place for the use of cast iron. When it was so used, however, he should have thought the number might have been cast on the door, instead of making it a separate casting and bolting it on.

Boiler testing seemed in page 10 to be looked upon as a doubtful expedient. But in the papers already discussed at this and other institutions the subject of riveting had been so thoroughly investigated as to the strength of the joints, that any engineer could now calculate what were the safe proportions, and could keep well within the elastic limit of the material, so as not to run any risk.

He was very glad to see the steam-pipe was made as large as 5¼ inches diameter inside, and in the heavy engines 7¼ inches diameter. This he thought was a move in the right direction, and one that might be followed in this country with great advantage. In general he believed the steam-pipe diameters were so small, and the velocity so high, that a great amount of power was lost in the cylinders. The boiler mountings were spoken of as being screwed into the fire-box shell. Of course the work could be made cheap, if done like that. Another thing that was not considered good practice in England, was the retention of the ancient try-cocks, which had here been abandoned for a long time past in favor of two water-gauge glasses.

In accordance with the almost universal practice in American engines, the valve chests were placed on the top of the cylinders, and the valves were worked through a rocking shaft. The only purpose, as far as he could see, of introducing such a complication was in order to get at the valves. But the valves were working all the year round, and were only wanted to be got at about once a year to see that all was right. It certainly seemed questionable therefore whether it was worth while introducing all those extra joints simply to save getting once a year into a rather awkward position to do a job that did not last long. At the present time indeed all those jobs were done with automatic machines bolted on and driven from a shaft.

By placing the dome on the wagon-top, it was mentioned that the heavier portions of the boiler were concentrated over the driving wheels, for increasing the adhesive weight. That was a very good object; but still it did not seem to be sufficiently realized thereby, because it appeared that a heavy cast-iron foot-plate was added at the back end of the frame.

About the "United States" metallic packing-rings, of which it was mentioned that a set lasted about twelve months, he was anxious to know more; and he trusted the author would give a more detailed statement on this subject. The mileage run could be the only true criterion of efficiency; for if time only were mentioned, the engine might have been standing in the shop for a considerable portion of the period.

For the eccentric straps it was stated that mild cast steel was used. But if there was any part of a locomotive for which cast iron had shown itself to be thoroughly adapted for use in this country, he believed it was the eccentric straps and sheaves running together.

The crank-pins were stated to have broken off in frost when the engine was left standing long; and he remembered hearing some years ago a similar statement about one of the Lowmoor tires having burst on each of three engines left standing in a shed in Nova Scotia. He wished therefore the author would give some additional information on this important point.

With regard to the wheels, these were certainly a very weighty and formidable item in an engine; and here again he thought the paper seemed somewhat inconsistent. The driving wheels appeared to have the peculiar distinction of hanging together by the boss and nothing else; because it was stated that at the end of the counter-weight on each side the rim was cut through, and then a tire was put on which was not fastened, so that the whole wheel hung together by the boss alone. Into that boss the axle was forced with a pressure of 80 tons, to which there could be no objection if it were a wrought-iron wheel. Beyond that pressure there was yet a further unknown splitting force by driving a key in tightly. This plan appeared to him to be inconsistent with the mode of dealing with the small truck wheels, in which there was no danger, unless their higher number of revolutions were regarded as dangerous. These truck wheels were stated to be coiled disks of wrought iron with Mansell tires, thus going quite to the opposite extreme of construction, after making the express driving wheels of cast iron and held together by the boss only.

The cost of 2·44 pence per lb. for the finished engine and tender came to £22 15s. 6d. per ton. Adding the 15 per cent., it amounted to only £26 per ton, which he thought could only be accounted for by the extent to which cast iron was used in the construction of the engines. But on the question of castings he might mention that he had recently been informed, by an engineer who had had large experience in America, that as a rule the American cylinders were so soft that he wondered the American engineers did not send over to England and get them cast here.

MR. BROWN'S ANSWER.

Mr. Halpin's remarks seem to be drawn from having *seen one* American engine on exhibition in Paris. The speaker's remarks on the "trellis work called the frame," and his inferences as to the brake arrangement, serve to emphasize his want of acquaintance with the subject, or he would have some knowledge of the usual arrangement of the Westinghouse driver generally classed as one of the wedge type of brakes and of the true reasons for the change made by the author in those shown.

The author may call the speaker's attention to four kinds of fire-boxes used in America. First, the deep box, limited in length by the axles, etc., and in width by the frames, which has about the same area as the corresponding English one for the same driving wheel base; with this type there is no trouble from the length of the box. The next type, where some increase of grate is necessary, is, in cases where the trailing axle is brought forward under the box, which is cut sufficiently shallow to clear the top of the axle boxes, and is extended backward to any desired length up to 10 ft. or over; these have given trouble when extra long, but are being superseded by the third type, which are raised above the level of the frames and made equal to the full width over frames, by which the length may be much decreased if the class of coal will permit the diminution of the grate area; these give but little trouble from their length. The fourth class is the Wootten fire-box, which is raised and extended laterally over the wheels to about 8 ft. wide. As there are no fire-boxes in England which would permit of comparison with the two latter, the speaker's remarks are without point.

It is questionable in Mr. Halpin's mind whether the wagon top is any benefit against priming, but the author can assure him that one winter's experience would do much to dispel such doubts. The speaker does not seem to appreciate the advantage of having the dome on the wagon top when striking a snow bank at 45 or 50 miles per hour, with the regulator wide open and the consequent rush of water forward which in a level top boiler gives an excellent chance of filling the cylinders, bursting off the covers and disabling the engine at the worst time, and it being then incapable of getting out, the line is blocked.

It is usually accepted as a fact that where there is any liability to prime, the water will creep up the steam pipe to the throttle by capillary attraction, and the drooping flange has been found a safeguard. The author also cuts the hole in the boiler much smaller than the dome. As to the dome connection, the author observes that flanging to the boiler is extensively practiced on large roads both in England and on the continent, even Mr. Webb's compounds with 175 lbs. per square inch being done so. Further, the author pointed out in the paper that as the dome on his engines is braced to the crown bars, it does not rely upon its connection to the boiler for vertical strength, which is a weak point in English practice. As the author does not block up half his fire hole with deflector plate machinery, etc., he fails to see the use of making it larger than will suit a shovelful of coal, and not gain anything in cost either.

As to the difference in type of joint between the S. A. and S. D. classes and the S. B. class, the author scarcely thought it necessary to point out that the former were designed for freight service almost entirely, while the latter were for passenger service, and would be expected to carry their full boiler pressure for a longer period without any decrease.

The author fails to see wherein wrought iron has any advantage over cast iron for a smoke box front, certainly not in repairs or renewals, as the extra cost in labor for repairing a wrought-iron front would pay for the cast-iron front and put it on; and the speaker would not care to repaint the number on the door every time it got blistered off by an extra collection of cinders in the box, to say nothing of the convenience of changing fronts in winter emergencies.

The author is of opinion that the lately published papers on the subject of riveting should draw quite as much attention to the question of getting reasonably light boilers as to extraordinary ultimate strength of joints, and the practice of Mr. Worsdell, in building the boiler of his latest compound engine with ¾" rivets, 1⅝" holes (?), 1¼" pitch in ½" plates, appears to coincide very closely.

On some Western roads the water is so bad that two sets of try cocks and no glass gauge is used, which insures them against neglect by the driver, and they can not be stopped by sediment if their use is thus enforced.

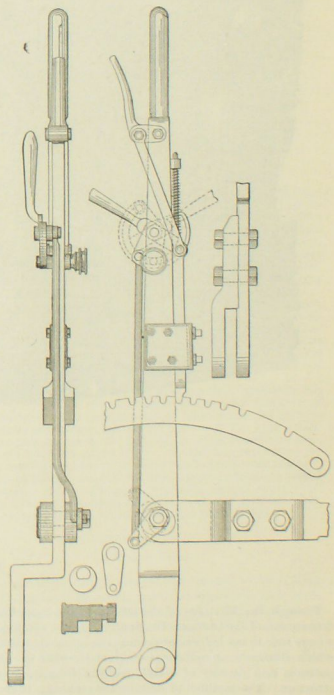
If the speaker only needed to examine valves about once a year they must have had very exceptional circumstances. The speaker would reconsider the matter being trifling at 20° below zero. Automatic valve-facing machines are also in general use in America.

The speaker's conception as to driving wheel centers hanging together by the boss only is quite true so far as it goes. The split in the wheel is filled with hard babbitt, and the wheel is then bored, turned and pressed on the axle in that condition. Very occasionally a defective one will burst, but that only insures the survival of the fittest. The tire is then heated and shrunk on, having an allowance of about $\frac{1}{176}$ of an inch per foot of its diameter, so that when cold it would take from 150 to 200 tons to pull it off again. The key is then fitted to the keyway to be tight sideways and is driven in.

There is no inconsistency in fastening the truck wheel tires by retaining rings, as it a proof of the author's answer to Mr. Burnett, that wrought-iron centers both destroy the tire and allow it to get loose by their flexibility. These, however, are of wrought-iron solid disk because a broken truck wheel is a tolerably sure precedent of a badly wrecked train, whereas such cases of broken driving wheels as have come under the author's experience have rarely caused more than a slight derailment. In most cases when a driving wheel cracks it is found and changed in time, but these are very few.

Player's Graduated Expansion Cam.

The reverse lever illustrated in the annexed engraving is one of the simplest and most effective devices ever invented for giving the locomotive engineer the means of graduating the point of steam cut off. Throttling the steam, a very wasteful practice, is done with locomotives to a great extent because the ordinary reverse lever and widely notched quadrant do not provide the means of regulating the admission of steam close enough to meet all the requirements of engine running. In the Player invention, the ordinary lever and quadrant are used so that no expensive change has to be made, but the pin connecting the reach-rod to the reverse lever is made cam-shaped or eccentric, and an attachment is put on for revolving the pin as the engineer desires. As the center of the pin in the lever is not coincident with the center of the part holding the reach-rod, revolving the pin has the effect of lengthening or shortening the reach-rod. This movement is made sufficient to cover the distance represented by the movement between two notches in the quadrant. If the engine is running along in, say the 9-inch notch, but is lagging a little and not enough to require the increased valve travel that the next notch will



give, the ordinary practice is to advance the lever and partly close the throttle, thereby losing to a great extent the advantage of using high pressure steam. With engines having this attachment, the lever operating the cam is turned, and the links dropped to the point where the engine will handle the train easily and no throttling is necessary. The arrangement is equivalent to the fine movement obtained by a screw reverse gear, and it has none of the disadvantages of the screw. The device, which is patented, was invented by Mr. John Player, master mechanic of the Central Iowa road. The improvement has been applied to a great many locomotives and works admirably.

Action of the Committee of Experts on Uniform Couplers.

At a meeting of the committee on uniform draw-bars and couplers for freight service, held in New York City, Wednesday, July 27, there were present, Mr. Wm. P. Shinn, chairman, and Messrs. A. G. Darwin, F. M. Wilder, James Meehan, Reuben Wells and T. L. Chapman. Messrs. O. A. Haynes and W. T. Small were unavoidably absent. Capt. O. E. Michaelis, of the Ordnance Department United States Army, the expert on physical tests, was present at the request of the committee.

The various points involved in the committee's programme of tests were freely discussed with the following result :

First, on motion it was unanimously resolved :

"That after full consideration of the results of the preliminary tests made under the direction of the committee, and in view of the evident superiority of a close coupler of the vertical hook type, which will couple to and with others of the same class and type this committee will admit to further consideration only such couplers as are of the type known as the Janney type of vertical hook couplers."

Second. Capt. O. E. Michaelis presented and read to the committee his preliminary report regarding a programme of physical tests of couplers. The report was on motion unanimously accepted without discussion.

In this report Captain Michaelis assumes that laboratory physical tests have heretofore had for their primary object the determination of the strength of the knuckles, hooks, tumblers or by whatever name the immediate coupling device may be called, and that critical examination into other integral parts of the coupling devices, such as the heads or housings and the bearing pins used as axes of rotation or locks, has been comparatively neglected. He believes, however, that a programme of drop tests can be devised which will reproduce every circumstance and contingency of dynamic strain developed in actual service, and which will give unimpeachable results in less time, at less cost and in a more controllable manner than if the same couplers were tried on moving cars. Then with the results of such a contemplated exhaustive test before it, together with the expert determination of its members as to the adaptability of the coupler for its special work, the committee could not fail to come to a correct decision.

Captain Michaelis makes the following suggestions about a programme of tests, viz.: That the impact tests should be divided under two principal heads. 1st, ordinary tests reproducing unusual conditions of service, and 2d, extraordinary tests reproducing unusual conditions of service. The preliminary tests should be service tests, and as the shocks incident to service are due to guided blows, the colliding masses moving on rails, there can be no objection advanced to the use of a drop moving in vertical ways. A programme of bumping tests cannot fail to eliminate the systems not worthy of serious consideration, and its execution will incidentally and necessarily develop the ability of the respective couplers to withstand the pulling strains due to the starting or sudden speeding up of trains. It might be well to subject the selected couplers to static strains on the testing machine, within limits, based upon conditions fixed by the committee as composed of railroad experts; for instance the steepest actual grade and the heaviest train going over it might be taken as the basis for this series of strain tests.

Third. On motion it was unanimously resolved :

"That the report of Capt. Michaelis be referred to the Committee on Physical Tests, which was appointed at a previous meeting with authority to make such physical tests as they may deem to be necessary for the full guidance of the committee in conformity with the suggestions of the report."

The Sub-Committee on Physical Tests consists of Messrs. Wm. P. Shinn, Reuben Wells and F. M. Wilder, with Capt. O. E. Michaelis as expert.

Fourth. In order to make provision for the service tests it was on motion unanimously resolved :

"That the secretary be instructed to call upon the owners of the couplers which are to be further investigated by the committee, requesting each to furnish the committee with five cars of forty thousand pounds capacity or over, equipped with his coupler and delivered at such point as may be arranged for, where service tests can be made of such cars in trains, and that the owners of such couplers as do not already couple with the Janney be requested to make such modifications as will enable them to do so, and use only such modified couplers on the cars sent to the committee."

It was also further provided that the matter of the arrangement for service tests should be referred to the same sub-committee as that which had charge of the physical tests, viz., Messrs. Wm. P. Shinn, F. M. Wilder and Reuben Wells.

After the transaction of some other routine business the committee adjourned subject to the call of the chairman.

Locomotive Matters in New South Wales.

The railways in New South Wales are operated by the government, and, as might naturally be expected, the methods of operating followed by the officers representing the party in power are subject to constant opposition, fault-finding and criticism by the party out of office. It happened that during the regime of a party lately in power the railways needed some new locomotives, and bids were invited by American and European builders to supply the engines, Mr. Scott, the locomotive engineer, favoring the building of the engines by an English firm without asking for bids. Mr. Scott is the head mechanical officer, and all his influence is said to be exerted in favor of Beyer, Peacock & Co., an English locomotive building firm; but in this instance he did not get his way, and bids were invited from all leading locomotive builders. Before the contracts could be made, however, there was a change of government, and with it came a change of policy. The first government appeared to go in for free trade; its successor appears to be trying to develop the resources of the colony, and wants the locomotives built at home. We give below extracts from a Sydney paper on the subject that are interesting. The Mr. Midelton referred to is an able mechanical engineer, who was at one time assistant, on an Australian railway, to Mr. R. H Burnett, who has of late years made himself noted as an assailant of the American type of locomotive. At one time Mr. Midelton was sent by Mr. Burnett to investigate the performance of some Baldwin locomotives and report thereon. The report made after a painstaking investigation was very favorable to the engines, but it greatly injured the prospects of the engineer who made it, for his superior officers wanted to have the American locomotives condemned.

The locomotives designed by Mr. Midelton and so favorably referred to by the Minister of Public Works were built at the Baldwin Locomotive Works, and are in all leading features American locomotives. It then follows that the locomotives proposed to be built in the railway shops in New South Wales are to be patterned closely after American types.

"The Minister of Works (Mr. John Sutherland) has written the following minute: 'With reference to the specifications for 28 goods and 16 passenger engines, it seems to me from a perusal of them that they provide for a different type of engines to any we have now running, and their adoption would, in my opinion, be a serious mistake. There are many provisions that would make the engines unnecessarily complicated and costly, and debar colonial makers from having any success in tendering. I think we might, for instance, substitute best steel for iron; it would be cheaper, and would give the locomotives a longer life. Three-fourths of the trade we have over the mountains on the steep gradients could be best and cheapest carried by one class of engines, simple in construction and powerful in action, but we have a number of engines of various designs that it would pay the department better in the long run to put on the scrap heap if we could be sure of replacing them by a class of engine more suitable to our requirements. I am not in favor of any increase in the rates for passengers and prodnce to augment our revenue, as I believe by improving our rolling stock we shall be able, with economical working, to improve our returns so as not to require any increase. We have at present a large traffic in live stock which has proved unprofitable both to the railway department and the owner, the latter asserting that the loss to him through delay in transit by rail, etc., is sometimes equal to 10 per cent. on the value of the consignment, and this must be taken in a degree as adding to the railway rates. We will always have a large traffic either in live stock or dead meat, and I do not think a permanent improvement will come until we have improved rolling stock for this traffic, both in engines and trucks. Stock trains should be run at almost the same speed as our mails and passenger trains, and should give precedence to nothing but them. For the purpose of obtaining opinions as to the best class of engines for this purpose, I wish an early report from Mr. Midelton, now Superintendent of Tramway Rolling-stock. Mr. Midelton has had a large engineering experience, both in England and in the colonies, and has already shown evidence of his ability with regard to his plans for the Goulburn running sheds, and in regard to his advice in connection with the Eveleigh workshops. He has already designed 10 locomotives, which, after two years' service, have proved to be the most economical in working that we have; and for these and other reasons, although he is not now in the railway locomotive branch, I should like his opinion on this question."

"Mr. Midelton, the superintendent of tramway rolling stock, in a memorandum states that, after a carfeful perusal of the papers which provide for the addition of 48 locomotives to the present stock, he is at a loss to understand why Mr. Scott, the locomotive engineer, should recommend, as the class most suitable for passenger traffic, those for which the Vulcan Foundry Company of England obtained the contract. Having gone carefully into the merits of the designs of these engines, the superintendent expresses his conviction that their unsuitability will be established on trial. They cannot be successful unless they are ruinously overloaded on their (four) coupled wheels. Mr. Scott does not think that a more suitable goods engine than the 'Mogul class' can be obtained; but the superintendent says that his views, based on a large experience of the running of these engines, are quite to the contrary, and he points out that it is evident that Mr. Scott now practically admits that the principal feature—the hauling power—is deficient. In reporting on the specification for twenty passenger engines the superintendent states that, unfortunately, the government have no less than 42 different 'classes' at the present time, of every possible shape and dimensions, 22 of which are for passenger traffic and the rest for goods traffic. This, he urges, is objectionable and costly, for almost any railway could be properly worked with, at the most, six different 'classes' of engine, and many lines could be worked with three. After giving comparisons between the various kinds of engines the superintendent points out that it is proposed to introduce another "type of engine" of practically the same power, but which will in practice be certainly not so serviceable an engine as the present one; but why it is done it is difficult to see. He contends it would be best in every way to go on reproducing the type which has proved to be best, instead of further complicating matters, and increasing difficulties and expense for no good purpose. An engine should, he says, have coupled wheels instead of four-coupled wheels, and he cannot see a valid reason for proposing to have such engines. There should now be reproduced in the government shops the engines and tenders found to answer colonial requirements best, and, as locomotive builders only manufacture very little of our engines and tenders, he considers the government should import the necessary raw material—consisting of steel plates for boilers, copper plates, boiler tubes, Staffordshire iron plates, steel tires, axles, etc., etc.—articles which could not for some time be made in the colony—direct from the manufacturers, in the same way exactly as the locomotive builders do at home; and he thinks that the government could obtain such material at the same—perhaps lower—prices than the manufacturers did. Then the government could, with the splendid special machine tools and new workshops at Eveleigh, fully and profitably employ the skilled mechanics and others constantly in constructing new engines and repairing old ones, under the supervision of specially trained expert officers on the spot. And the superintendent feels confident that the total cost of engines built in this manner, under proper discipline and control, would not exceed the highest—perhaps the average—tender which would be received for supplying the engines now under consideration, as the profit now paid the manufacturers, cost of freight, inspection, trial, dismantling, and other items would about balance the extra price of labor here. Indeed, unless this is done, he does not see how the new Eveleigh works, which have cost about £600,000, can be fully utilized. Summing the matter up, the superintendent considers that the author of the specification has ignored the main questions of first cost, utility, simplicity and efficiency; and he has no hesitation in saying that a simpler, a far more efficient, and less costly engine and tender could be made in the Government workshops at Eveleigh than the one proposed. He strongly recommen is the construction in the Government shops of twenty-five more of the 304 class of engine, which were designed for and intended to work five different kinds of traffic, viz., mail trains, fast cattle and goods, suburban passenger and goods traffic, and shunting generally. Referring to the specification for twenty-eight goods engines, which 'it is evident are intended to be made by Messrs. Beyer, Peacock and Co.,' the superintendent states that, in his opinion, it would be a serious mistake to have such engines constructed. He considered the consolidated type have proved themselves to be the best goods engine we have, and strongly recommends that the proposed new design be abandoned, and that 25 more of the consolidated engines be built in the Eveleigh works. Nearly all the arguments he had advanced against the passenger engines could be made to apply to the proposed goods engine. He would further construct a great many new engines of a more suitable type in place of a lot of obsolete engines goverment seemed unable to utilize. They had the best appliances for the purpose, and unless this were done it was difficult to see what use the appliances could be put to. Indeed, it was a huge co-operative concern, in his view, in which every railway man was personally interested, and as the railways were State properties the whole question was a national one."

We understand that the Minister of Public Works is having his way, and that the engines will be built under the supervision of Mr. Midelton. Meanwhile an opposition journal thus comments on the transactions :

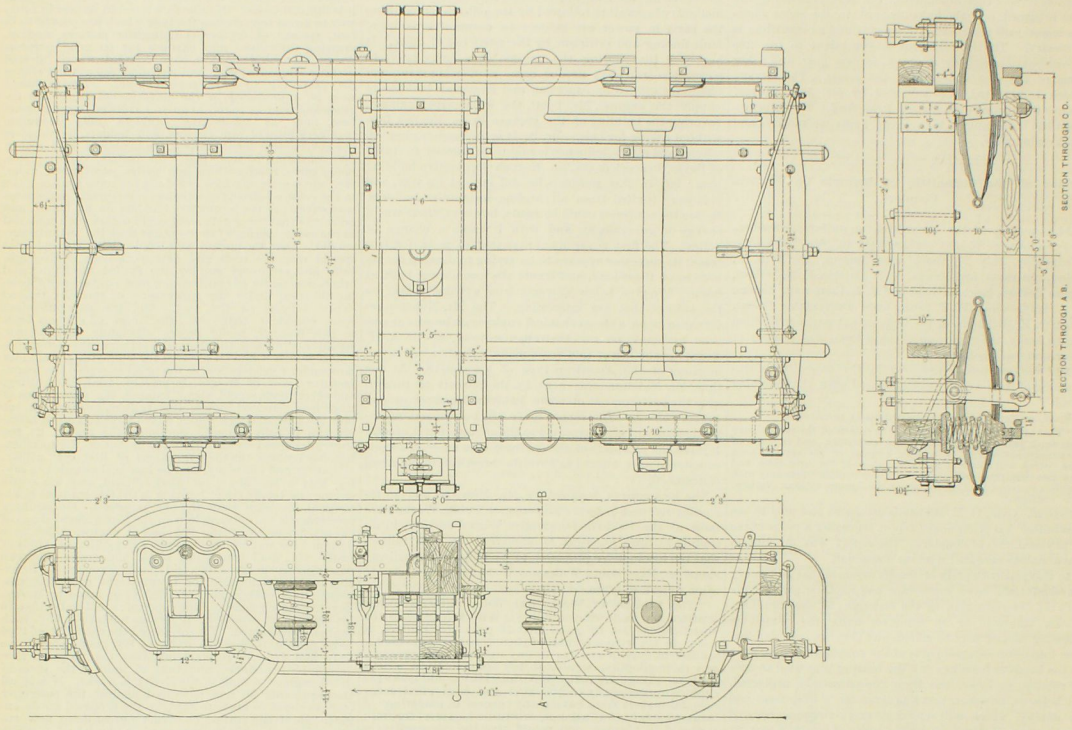
"Mr. Sutherland assigns as one of his reasons for his reference to Mr. Midelton that he had already designed ten locomotives which after two years' service had proved to be the most economical in working. Mr. Midelton, in his report, writes without hesitation or qualification. He is 'at a loss to understand' why Mr. Scott should have recommended the proposed class of passenger engines, and he says it would be a serious mistake to construct the Moguls. He recommends for the passenger engines what is known as class 304; and for the goods traffic, engines of the consolidated type. The result is that of 50 new locomotives to be constructed, twenty-five are to be of Mr. Midelton's design, and twenty-five of a design preferred by him to that which Mr. Scott had recommended, and if an eligible tender should be received for their construction in the colony, Mr. Midelton is to have the superintendence.

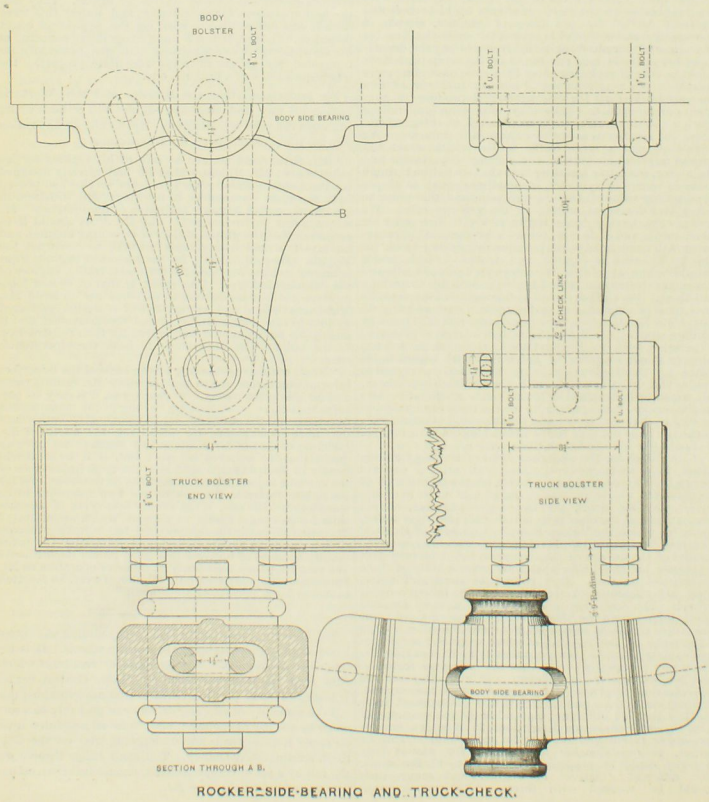
"Now, without pretending on the basis of the imperfect information before us to say whether Mr. Scott is right and Mr. Midelton wrong, or *vice versa*, it is easy to perceive that there is something wrong in the management of affairs in the railway department. Mr. Sutherland may have good reasons for preferring the advice of Mr. Midelton to that of Mr. Scott in this matter: we have no doubt that he believes he has; and, if it be so, it will hardly be denied that, considering the large importance of the case, he is justified in doing what he considers best for the public interest. But there are two questions to be considered. The one, What are the best types of locomotives for passenger traffic and goods traffic respectively? The other, What is the best method for enforcing responsibility, securing subordination, and promoting the satisfactory conduct of business in a great public department? We venture to say that such a mode of operation as Mr. Sutherland has adopted would seldom, if ever, be resorted to in any large private establishment."

The Hinckley Locomotive Works are building an express locomotive with a single pair of driving wheels. It is intended to use it on the "Flying Yankee" fast train which runs over the Boston & Maine and Maine Central roads. It possesses many peculiar features that are experimental. All the difficulty of slipping drivers can probably be overcome by the use of the sand blast now successfully used on many English roads and undergoing trial on the Chicago, Burlington & Quincy. The sand being thrown on the rail by a jet of compressed air, cannot be blown off before the wheel reaches it.—*Ex.*

PASSENGER CAR TRUCK—GRAND TRUNK RAILWAY (Great Western Division.)

With Combined Rocker Side-Bearing and Truck-Check Attachment. Wheels, 43 inch.





ROCKER-SIDE-BEARING AND TRUCK-CHECK.

The engravings illustrate a combined rocker side-bearing and safety-link for outside bearing trucks, which has been in successful use for some time on the standard four-wheel trucks of the Grand Trunk Railway, and is now being attached to all the trucks of this pattern on the road.

Its principal feature is the safety-link, which takes the place of check-chains or other devices for keeping trucks straight with track in case of derailment. The links are made of $\frac{3}{4}$ in. round Low Moor iron. The links, $\frac{1}{4}$ in., are longer than vertical distance over pins, to admit of proper radius for curves.

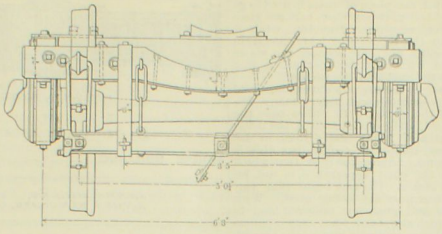
The bearings are fastened to truck and body bolster with $\frac{3}{4}$ in. U-bolts, giving ample strength equally divided to withstand any strain necessary to maintain alignment when truck is off the track. The rocker principle in the device makes the curving of trucks much easier than with the ordinary friction on bearing plates. To lift car body off the trucks, it is only necessary to remove pin at bottom end of rocker casting. The link holds body and truck together, preventing body from turning over, which often happens in a wreck, when body and trucks are not connected.

The advantage of outside over inside bearings is generally admitted, although the cost may be a little more.

Present Cost of Rolling Stock.

The Chicago & Northwestern Railway Company build a few locomotives and cars in their own shops, but the great bulk of their renewals is done by purchase from first-class makers. The prices they pay for their rolling stock may be accepted as a fair average of the current prices. Last year they added to their rolling stock equipment 37 locomotives, each costing $8,150; 10 first-class passenger cars, each costing $4,555; 9 combination cars, each costing $3,392; 4 baggage cars, each costing $2,608; 10 caboose cars, each costing $833; 975 box cars, each costing $428; 100 ore cars, each costing $487; 2 milk cars, each costing $2,567; 500 gondola cars, each costing $330; 1 steam wrecking car and tender costing $5,676; 1 steam shovel, costing $3,399; and one tender for wrecking car costing $1,129.

Mr. L. C. Noble, Master Mechanic of the Houston & Texas Central, is the inventor of a very simple form of nut-lock and washer, which is meeting with great success for track purposes. The washer is a steel plate, with a slit made through the bolt hole, the edge of the slit having a set which makes it act as a permanent spring on the nut. This puts a constant tension on the bolt and nut and there is no working loose of the latter.



Adventures of a Chicago Built Locomotive.

About the year 1854, when Chicago had not yet attained the proud position of a manufacturing and hog-packing metropolis, when the business men who had located there were still in the habit of striving to draw new enterprises to the place, a machine firm was induced to embark in the business of locomotive building. There was said to be millions in the business, but Scoville & Co., the Chicago locomotive building firm, left the gold mine of that department of industry unopened, that is, so far as drawing riches to themselves was concerned. In the early days of railroading, there appeared to be great fascination about the business of locomotive building for many owners of machine shops. Hosts of them were ambitious to demonstrate that they could build a good locomotive, and many of them proved that they could build an engine that would go, but few of them demonstrated that they could build locomotives that would pay.

Scoville & Co. went into the work of locomotive building ambitiously. They had a shop at the corner of Canal and Van Buren streets well filled with tools, and fairly well adapted for the work they were going into. The burning ambition of Mr. Scoville, the head of the firm, was to build locomotives that would eclipse the McQueen engines, which were then the pride and boast of Western railroad men. He had at one time some connection with the Norris Locomotive Works, in Philadelphia, and he believed that the Norris engine could beat creation, and his first engine was modeled after the Norris pattern.

The first engine built was called the "Enterprise," and had the pyramidal fire-box and other features so well known among Norris engines. But before that locomotive was sold the builders found out that the world of locomotive design was advancing, and that pyramidal fire-boxes were no longer in demand. The next engine turned out was the "Falcon," which had the ordinary wagon top boiler, and the intention was to demonstrate with her that Chicago builders could make engines that would leave other builders away behind. The engine had cylinders 15 by 22 inches and two pairs of driving wheels 66 inches diameter. She was intended for the heavy passenger service of the time.

At this time the Galena & Chicago Union Railroad was considered the crack line of the West. The road was stocked with McQueen engines, and the men running them were firm believers in their superiority to any thing on wheels. The Galena road was supposed to have a set of the ablest engineers that ever pulled the throttle. Nearly all of them afterwards filled positions of importance and trust in the railroad world. Among them were George I. Chalender, who was afterwards superintendent of motive power of the Chicago, Burlington & Quincy; Thomas Burgess, who became master mechanic of the Chicago & Northwestern; I. B. Bowen, I. D. Johnson, Robert Hoffman, Wm. B. Brown, Dan McMann, H. P. Vedder, Aaron Hathaway. George Rolf, and others of almost equal celebrity. All old Western railroad men will recognize these names.

The Galena road bought the first five Scoville locomotives, and a spirit of emulation seized the men assigned to the engines to compete successfully with the McQueens already in service. The Falcon was assigned to Robert Hoffman, who was an intimate personal friend of the builders, and was noted among railroad men as a noisy, pretentious, whoop-her-up type of engineer. He guaranteed to hustle the engine into the front rank on the first fair trial. This was to be made as soon as the engine was in good running order on the morning passenger train west bound from Chicago. When the eventful day arrived, the Falcon coupled on to sixteen passenger cars and pulled out in the midst of an ovation given by the friends of the builder and the admirers of Hoffman. Hoffman was noted for overweighting the safety valves, and it was understood that he carried on this occasion over 200 pounds of steam to the square inch. At all events, it was discovered before he was done competing that the crown-sheet was bagged between the stay-bolts through the effects of excessive pressure. On this occasion, however, carrying recklessly-high pressure did not avail, for he lost two hours in the run of 120 miles to Freeport.

Next day a McQueen engine, of the same size as the Falcon, coupled on to the same train, but consisting this day of seventeen passenger cars, and pulled out 35 minutes later, Mr. Thomas Burgess being engineer. This train ran to Freeport and made all the stops and reached the end of the trip five minutes ahead of time. The Falcon was beaten, and Chicago's locomotive enterprise received a blow from which it never recovered.

All Hoffman's energy and schemes failed to make the engine a success. She was tried on all kinds of service, but in every case failed to come nearly up to the performance of other engines of her class. Other engines subsequently built by the same firm did their work about as well and as economically as the McQueens, but the Falcon was worthless. She turned out to be the kind of bird that would neither fly, run nor pull, and Hoffman gave her up in disgust and accepted a position as master mechanic on a road in Wisconsin.

The belief which still lingers among many railroad men that a group of engines may be built from the same templates, and that one engine may turn out much better or much worse than the others, was very strong in these days, and most of the engineers and other mechanical men belonging to the Galena road believed that the trouble with the Falcon was some species of incomprehensible but incurable perversity. Most of the people most interested in getting the engine to work properly gave her up as a hopeless case. This opinion was not, however, shared by Mr. William Wilson, now superintendent of machinery of the Chicago & Alton road, who was then a gang boss in the Galena road shops at Chicago. One day when the engine was in for repairs he obtained permission to give her a thorough investigation. In the firstplace he went over the valve motion and found that to be in about the same condition as the value motion of the other engines. Then he took the dome cap off and examined the throttle, and found that nothing obstructed the admission of steam into the dry pipe. The steam passages between the steam chest and cylinders were next subjected to searching scrutiny, but there was nothing there to prevent the steam from passing through freely. The case looked puzzling, but Mr. Wilson had infinite faith in steam acting the same part in that engine that it did in others, if permitted to reach the cylinders; so he determined to follow the passages back to the throttle valve. As a preliminary, he took down the steam pipes and found they were in about the same condition as the steam pipes of the other locomotives. Then he got up to the branch pipe with the intention of feeling inside the dry pipe, but there an obstruction was found. The branch pipe was taken down, and it was discovered that a centering plate which was fastened to the dry pipe when the joint was being turned, had not been removed, and all the opening left for the steam to pass through was two ¾ inch holes which were in the plate. When the plate was removed, the Falcon proved as good an engine as any of her inches on the road, but her first bad performance inflicted such severe injury to the reputation of her builders that it hastened their failure, which came a year or two later.

Advantages of Using High Pressure Steam.

In the course of a discussion on a subject connected with the steam engine at the last meeting of the American Society of Mechanical Engineers, Mr. Charles T. Porter, the well known engineer, said:

"Disregarding at present the condensation of steam as it enters the cylinder, we find the economy of the engine to be shown by the proportion that the mean effective pressure bears to the terminal pressure in the cylinder. The former represents the work done, the latter the steam consumed.

"If in a non-condensing engine admitting steam at full stroke, an absolute pressure of 20 lbs. is maintained, and a back pressure is suffered of 19 lbs., or 4.3 lbs. above the atmosphere, then only one-twentieth of the steam is utilized. If in a similar engine, an absolute pressure of 30 lbs. is maintained, and a back pressure of 15 lbs., or .3 of a pound above the atmosphere is suffered, then one-half of the steam is utilized. We have here an immense advance in economy. The same weight of steam does ten times the work it did in the former case.

"If in such an engine an absolute pressure of 150 lbs. is maintained, and the same back pressure of 15 lbs. is suffered, we have a second advance in economy almost as great as the first one. Nine-tenths of the steam is now utilized, the same weight of steam does eighteen times the work it did in the first case. This would not be very bad practice. Probably a majority of non-condensing engines run with less economy than this.

"Now, let us cut off our 150 lbs. at one-fourth the stroke. The terminal pressure is 37.51 lbs., and we are using only one-fourth as much steam as before. The mean effective pressure has fallen only to 74.5 lbs., or to twice the terminal pressure. The same steam now does twice the work it did without expansion, or thirty-six times the work done in the first case.

"The gain by employing high pressures is very great, especially when working expansively. This will be seen by comparing with the above the inferior results obtained by cutting off at the same point one-fourth the stroke, with 75 lbs. absolute. The terminal pressure is now 18.75 lbs. The mean effective pressure is 30 lbs., or only 1.6 times the terminal pressure. Instead of 36 times as much, only 28.8 times as much work is now done by the same weight of steam as was done in the first case. The gain in non-condensing engines from using high pressure is due to the fact that a smaller proportion of the total pressure is wasted in overcoming the resistance of the atmosphere.

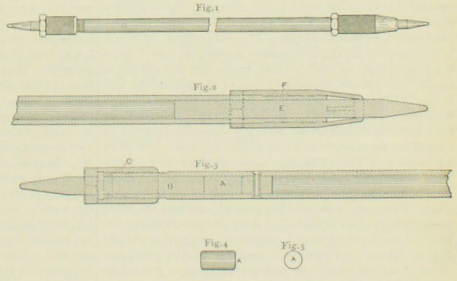
"In non-condensing engines with ordinary pressure there is no gain made in economy by cutting off earlier than one-fourth of the stroke. In this class of engines we are absolutely limited to three expansions. If we cut off earlier than this we merely reduce the power and so the value of our engine with a loss instead of a gain in economy. It is true that if the pressure be raised, as from 60 lbs. to 100 lbs., and the steam be cut off earlier to do the same work, the consumption will be reduced. This is owing to the higher pressure. If a smaller engine be substituted, in which the higher pressure must follow to one-fourth of the stroke in order to do the same work, a still further gain in economy will be made."

Fifteen Tiffany refrigerator cars have just been completed at the Chicago & Northwestern shops in West Chicago. The Harrisburg Car Works have also just finished an order for ten of these cars. Other orders are being filled by car shops at various points. The fast line composed of Tiffany cars, designed especially for carrying fruit from California to Eastern points, is meeting with much success.

Small's Graduated Boring Gauge.

This is an instrument of simple and inexpensive construction, by which the boring of locomotive wheel tires or other annular bands of metal designed to be fitted closely upon bodies of cylindrical surface by being shrunk thereon may be accurately and uniformly regulated to desired and determined degrees of allowance for shrinkage.

The accompanying illustration will need only a brief description. Generally stated, the gauge consists in the combination with a tubular body of a fixed stop *C*, Fig. 3, and removable gauge block *A*, each adapted to fit between the fixed stop *C* and one of the end spindles *B*. In the use of the gauge for any sizes, two of these blocks are



required; the first to be used may be termed the "primary measure gauge block," being of a determined length, say one inch, and the other, which may be termed the shrinkage or allowance block, being made shorter than the first by a distance exactly equal to the amount of shrinkage which it is desired to allow in the tire or other article to be bored, say of a length of sixty-one sixty-fourths ($\frac{61}{64}$) of an inch, to give three sixty-fourths ($\frac{3}{64}$) of an inch allowance, which is usual for a tire designed for a 56 inch wheel.

Additional shrinkage blocks, each shorter than the block *A* or prime measure block, are provided for different diameters required to be bored, thus substituting the regulation of an accurate gauge for the discretion of the workman in boring tires of different diameters.

The utility of this gauge is not confined to tires alone. It is being used for crank pin and driving-axle fits and other similar purposes.

In reference to fine adjustment, it is equivalent to the micrometer caliper.

The unavoidable wear of the points consequent upon daily use, does not in the least affect the constant accuracy of this gauge, which to mechanics will be apparent at a glance.

The gauge was designed by Mr. H. J. Small, assistant superintendent of motive power of the Philadelphia & Reading Railroad.

Communications.

How to Level a Locomotive Having Worn Tires.

Editors National Car and Locomotive Builder:

Will you please answer the following questions through the columns of your paper :

1st. In the case of a locomotive engine of the American type, with driving wheels 5 feet centers. After the diameter of driving wheels, through the continual wear and occasional turning of tires in lathe, has become reduced to such an extent that the engine drops down behind until it is about 1 inch lower at center of the back driving box than it is at the center of the front one. Is the engine then in your opinion more liable to slip on the rail when pulling, than when the driving tires were thick and engine stood level?

2d. Then, if, with the object of making the engine less liable to slip, or with any other object in view, you wish to raise the engine behind until it is level, what way would you consider best to do it, providing that the driving springs have already sufficient set to raise the engine up until the top of frames almost touch the bottom side of top part of spring saddles, and the engine still stands low on the back box, or at the back end as I have represented?

Would putting in smaller wheels in engine truck, or putting in longer spring saddles under driving springs, have the effect of preventing engine slipping, and if so, which way would you prefer to overcome the difficulty?

ST. THOMAS.

Answer.—1st. A locomotive becomes more liable to slip after the tires get worn, because the wheels are then practically smaller, and the pistons have relatively more power to slip them when the wheels were of the size due to new tires. But the engine is not more liable to slip because she does not stand level on the wheels.

2d. You could not level the engine by changing the length of the spring saddle. When the engine is at rest, the driving axle-boxes ought to be half-way between the pedestal brace and the top of the jaws, so there is no means of leveling up the back end of a locomotive when the tires get worn. The usual way to level the frames under these circumstances is to lower the front end, and that is generally done by reducing the length of the centre pin. A common practice is to have plates on top of the truck center, which can be taken out to lower the front end.

The Extension Smoke-Box Not a Smoke Consumer.

Editors National Car and Locomotive Builder:

In the interesting discussion that took place in the last Master Mechanics' Convention on Extension Smoke-Boxes, several of the speakers claimed among other merits for the extension front end, that it was a good smoke consumer. I have no intention of saying a word for or against the long front end as a spark arrester, that being the purpose for which it was designed, and the purpose for which it is applied by all rational master mechanics, but I must raise objection to claims being made for the extension smoke-box that are manifestly absurd in themselves, and contrary to scientific principles. Smoke is formed through imperfect, combination of the gases in the cone with those that maintain combustion, and the operation, perfect or imperfect, must begin and end in the fire-box. The man who says that the extension front end prevents smoke must necessarily imply that the combination of the gases is completed in the smoke arch, a thing which never happens. Every engineer who has paid the smallest attention to combustion knows that after the gases pass from the fire into the flues, reduction of temperature happens so rapidly that no farther combination is possible. If the small particles of carbon which we call smoke were to enter into combination with oxygen in the smoke-box, that part of the locomotive would be kept constantly red hot, yet on no other hypothesis can it be shown that adding 30 inches to the smoke arch provides the locomotive with a smoke consumer.

LABORATORY.

Care of Passenger Cars while in Service.

The following paper on this subject was presented by Mr. A. J. Bishop, of the Cleveland, Columbus, Cincinnati & Indianapolis road, at the last convention of the Master Car Painters' Association:

As to the proper care of passenger cars while in service very few roads have the facilities upon their lines for such care. How many roads have sheds or other buildings for the protection of their passenger equipment at terminals when such equipment is not in use? Is not the exposure of these cars to the weather more detrimental to the painting and varnishing than months of running service? In my opinion it is. Being exposed to the sudden change from heat to cold, to frost, to rain, wind, hail, etc , and *vice versa*, much injury is done, especially to the varnish. The first recommendation I can offer for the proper use of passenger cars when not in use, is protection from the weather by the building of suitable sheds or buildings. In the care of passenger cars railroad companies are using various modes and ingredients for the purpose of keeping their passenger cars clean in appearance and with very moderate success in many instances, and in others injury is being done to the paint and varnish. The various ways of cleaning cars at terminals that have come under my notice, and of which I will make mention are, first, removing the dust by wiping over the car with waste. This does and does not remove the dust, for, as I have noticed, one piece of waste is used to go over the entire car, and one, two or more cars are gone over with the same piece of waste. Therefore, while it removes the dust from the top, it also leaves a certain amount of dust remaining, not only because the waste used has become filled with dust, but because it, in a measure, rubs or grinds the dust into the varnish.

2d. Removing the dust by the use of a duster, hose and water, sponge and water or brush and water, many dispensing with the use of the duster. In either case the duster should first be used, and even without it the using of water as above mentioned is far better than to use waste. But for the proper care of passenger cars this is not sufficient. While it may remove the dust, that which gives our passenger cars the worst appearance is not removed—the smoke and grease. For this I find that various soaps and other admixtures are being used. With some of these the smoke and grease is removed and in many instances the varnish also, or at least each application of these soaps or other ingredients injures the varnish and shortens the life of the work. In some instances the durability of the painting and varnishing is somewhat lengthened by the use of oil.

3d. In many instances cars are washed with some of these soaps or ingredients too frequently, and in others not frequently enough; or they may be washed by incompetent men and injury done either directly under the supervision of those who know not the nature of paint or varnish. One other reason which may be given is the too great service required of cars before being revarnished. Besides the building of sheds or buildings for the protection of passenger cars when not in use, I suggest the following modes for the cleaning of cars: Inside, dusting daily, or when at any terminal; washing with a weak solution of soap and water at least once a month; to be oiled carefully once every third or fourth month with a mixture of the following proportions: two-thirds raw linseed or olive oil and one-third turpentine, to which may be added about one-sixteenth part coach Japan, well mixed and applied with clean white waste or cotton cloth. Outside, dust removed daily or when at any terminal by the use of duster, hose and water, dust and then sponge and water, or with soft brush and water; in either case water used freely. Cars to be washed with a soap that can be easily applied that will act quickly with the least rubbing and be thoroughly removed with water at least once each month while in service; cars then to be oiled nearly once in four to six months with an admixture of three-fourths raw linseed oil and one-fourth turpentine, to which may be added one-sixteenth part coach Japan, this oil to be applied as mentioned for inside of cars; this will in a measure lengthen the life of the varnish and allow the cars to be in service from 24 to 36 months without revarnishing.

But it is my opinion that all cars should be varnished at least once each 12 to 18 months, thus at all times having sufficient body of varnish upon the cars to enable the washing mentioned to be accomplished safely. This would give greater care than possibly the entire amount of washing and oiling that I have referred to. Too often we find that the cars are left in service until the body of the varnish is entirely worn away or has lost its elasticity, and in many instances necessitating the recoloring of cars which otherwise would have looked bright and clean.

Chicago & Alton Dining Car Service.

The assertion is frequently repeated that operating dining cars is an expensive luxury to railroad companies, that in nearly all cases this service entails financial loss to the roads, and that few roads would provide meals on the trains were they not forced into the practice by their competitors. Western travelers are nearly all ready to testify that the best dining car service in the country is provided by the Chicago, Alton & St. Louis Railroad, yet we have recently received figures from Mr. C. H. Chappell, general manager of the road, which shows that the dining car service is conducted at a fair profit. In conversation with Mr. Chappell, we learned that great care and vigilance is constantly needed to prevent leakages that would make the service an expense to the company. There is not only the money received from patrons to be closely watched, but there are innumerable channels which the supplies are apt to turn into that carry them away from the service of the cars. Below we give the figures showing earnings and expenses for the year 1886:

1886.	Expenses.	Earnings.	Profit.	Loss.
January	$3,321.72	$3,118.70	.....	$203.02
February	3,268.04	3,206.40	.....	61.64
March	3,919.80	4,517.85	597.96	.....
April	3,706.23	4,104.75	398.52	.....
May	3,970.55	4,207.90	237.35	.....
June	3,865.90	4,098.52	232.62	.....
July	4,040.29	4,731.15	681.86	.....
August	4,095.58	4,469.95	404.37	.....
September	4,443.57	5,410.90	967.33	.....
October	4,021.13	4,723.03	701.90	.....
November	3,423.78	3,330.30	.....	93.48
December	3,383.07	3,148.60	.....	235.07
	$45,439.35	$49,068.05	$4,221.91	$593.21
Net profit	.....	.....	$3,628.70	

The New York Railroad Commissioners, in their annual reports, have repeatedly called attention to the hazards to which brakemen are exposed in the running of trains, and have suggested as a measure of safety that a low railing of iron pipe about 18 inches high be put on the edges of every freight car roof, so it could be seized by the men and prevent them from falling. The commissioners in their report for 1886, recently published, express regret that this suggestion has been entirely ignored by the railroads, and as a reminder of this fact, make the further suggestion that the subject is well worthy of legislative attention. The Car-Builders' Association have already recommended various kinds of safeguards for the protection of trainmen, but we do not remember that the railings referred to is one of them. The committee now in charge of the subject of safety appliances will doubtless report upon the suggestion of the commissioners at the next annual convention.

NATIONAL CAR AND LOCOMOTIVE BUILDER

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BY

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

Running Locomotives without Regular Crews.

In the report on "What Control has the Engineer over the Wear of Driving Wheel Tires?" prepared by Mr. John Mackenzie for the railway master mechanics' convention, a decided position is taken against the practice of running locomotives promiscuously without having regular men appointed to them. The report says: "Your committee is of the opinion that it is much more economical to have regular engineers on engines, and that a saving of at least 10 to 20 per cent. is shown in the wear of tires, and it must necessarily follow that the same saving is shown in other parts of the machinery. When it is necessary to use more than one crew on an engine, two crews should be assigned to one engine and held responsible for the same. When so assigned and made responsible for the proper working and condition, they become familiar with the peculiarities of the engine." Had this report been submitted earlier in the session, we believe it would have brought out a free expression of opinion from the members on that vexed question of long and short runs for locomotives, and that the views of the members on the subject would have been seasonable and valuable. The question certainly has two sides, some able managers thinking that keeping the locomotives circulating round without attaching any set of men to them is the most economical method of operating, while others equally able consider the plan an endless source of waste. So far as we can learn by extended injuries respecting the working of the system of running locomotives without regular crews, the plan is popular with the transportation departments on many roads, but the mechanical departments have nothing to say in its favor. There is a belief among train masters and superintendents, that they can get more mileage out of the locomotives when they are run without regular crews, as all the delay in getting an engine that has come in with a train back to the road again, is the time needed to clean the fire. The men responsible for the maintenance and repair of the locomotives say, on the other hand, that where it is necessary to run engines more than one set of men can keep up with them, it is better to put on two regular crews, and that the average mileage made when engines are habitually turned round and sent right out again, is not so high as it often appears to be, the additional repairs due to the machinery being permitted to run down, making heavy periodical breaks into the running record. The Chicago, Burlington & Quincy road have lately introduced upon some divisions the practice of making a conductor, engineer, fireman and two brakemen follow a certain way-car and all keep together, taking out any engine which may be available for the run. The plan is said to be very popular with the transportation department; but the more they see of its working, the less the master mechanics like it.

We believe that plan, and every other one which places men habitually on strange locomotives, to be expensive mistakes. It is all very well for men, such as train masters and superintendents, who are not familiar with the idiosyncrasies of machinery, to say that a locomotive of a certain class is the same as the other engines of that class, and that there is nothing to learn about one which cannot be found

out by the other: but such talk is based on misconceptions of facts. Locomotives of the same class are practically equal so far as capacity for doing work is concerned; but the machinery is wearing all the time and the engineer who knows the condition of every bearing and rubbing part and every other detail of the machine will work the engine more successfully than a stranger. A certain crank-pin needs a little extra watching to prevent it from throwing oil, an eccentric strap has been hot within the memory of man, and extra attention may save a repetition of this source of delay. The tires are pretty well worn, and this engine needs humoring in getting away from a station or there will be lots of tire grinding done. The injector check has a tendency to leak, and starting the injector requires skill begotten of practice with that particular water passer. With these and other peculiarities, too numerous to mention, to watch, two strange men step on to the engine on a dark night. The engineer cannot find a torch to light his way in oiling round, but he sticks a piece of waste on the packing hook, illuminates the darkness, and pokes the oil can at all the holes he can find. Then presently they pull out. The fireman has been instructed on general principles that he must always maintain a light fire, and fire often. There are fingers broken off two grates well back, and they let so much cold air through that the steam goes back to 100 pounds, and the engineer is ready to use cuss words before the fireman concludes that he must fire her heavy. He does so the remainder of the trip, and the engine does not steam well, but burns a ton more coal than she would have done with a fireman familiar with the condition of the grates. The engineer gets the train going, then hooks the links up to the second notch from the center, which he supposes to be cutting off at 9 inches, but as a matter of fact the engine was cutting off at 10½ inches, and he uses up a half ton of coal extra on the run through, not knowing what the engine would do. He is just getting to know her ways when the end of the trip is reached, and there is no more interest needed for the peculiarities of that engine. If he does not meet with delays through want of acquaintance with the engine he is fortunate.

No operation of railroad working can be carried on safely without the aid of human intelligence, and no work can be done economically without human care and supervision. The system of running locomotives without regular crews aims at dispensing with the advantage of men's interest in the machine, and we believe if the method were calmly investigated without prejudice or favor it would be found to be one of the most expensive steps of would-be progress that ever railroad companies have taken.

Reported Air Brake Failures.

The morning papers, on the authority of the Associated Press dispatches, recently announced that owing to failure of the air brakes, a disastrous collision had happened to a passenger train on the East Tennessee Railroad. Considerable experience with the automatic air brake had given us the impression that it was impracticable for the brake to fail if the hose was connected and a pressure of air kept up, und we have got in the habit of inquiring into the particulars of reputed air brake failures, as we are anxious to find out how such a thing can happen. In answer to a letter asking particulars of the case mentioned, the responsible officer says, "the air brakes were in perfect order and were applied by conductor in ide of coach. The engineer reversed his engine but failed to apply the air brake." So the failure of brakes happened through the engineer losing his head and failing to apply them.

It is quite natural when an engineer makes a miscalculation of the train speed, or of the stopping power of his brake, and in consequence causes an accident; or, when seeing the probability of a collision suddenly impending, he loses his presence of mind and "throws the engine over" without making use of the powerful provision provided for stopping in the shape of good brakes, and dashes into the hind end of a train, that he should attribute the accident to a failure of the brake; but it is a pity that representatives of the press accept so readily allegations of the kind, and spread them over every news center. Serious railroad accidents have been numerous enough of late to alarm and terrify the nervous portion of the traveling public, and it is a most reprehensible act on the part of the press to spread false alarms of danger, which is certainly done by repeating idle and unfounded rumors, which lead people to believe that the automatic brake is not a reliable means of stopping trains at all times.

In following up investigations of reported failures of the air brake, we found cases where the automatic brake did not work, but no part of the mechanism was at fault. The St. Louis express started from a town in Indiana which was the beginning of a division, and there was a run of fifteen miles to the first stopping point, a railroad crossing. The time was fast, and although a freight train happened to be on the crossing, the engineer of the passenger train ran well up before he tried the brakes, and then he found there was no air to apply the brakes with. The engineer had forgot to start the air pump. We have known several other failures occurring through this cause, though happily none of them led to running through a train. But there was a brake failure accident in Chicago a few months ago which resembled that one in some respects. The air pump of a suburban passenger engine broke one of the valve rods, and consequently stopped. The engineer knew that the pump had stopped, but he had only a few stops to make, and he depended upon the hand-brakes, without notifying the conductor that the hand-brakes would be required. It happened that the track was blocked at the next stopping point, and not being prepared, the trainmen did not respond quickly to the call for brakes, and in consequence that train ran into the side of another passenger train and all the Chicago dailies announced in conspicuous headlines an accident through failure of the air brakes. Still another representative case of brake failure was to a Chicago surburban train. A double-ended locomotive was coupled on to a train at the starting station, and after the brakes had been tried, the engineer discovered that the air hose was stretched under the long draw-bar that reached over the pilot instead of being above it. He directed one of the trainmen to change the position of the hose, and in doing so the man shut the air pipe cock and forgot to open it again. The train started and the first call for stopping happened to be a car of railway iron on the main track, which got badly scattered. We have evidence which shows that several brake failures that became public were caused by the failure of the trainmen to couple the air hose before starting. In fact, closing the air pipe cock, or neglecting to couple the hose, are the two leading causes of reputed brake failures. Among our notes of reputed air brake failures, is one where an engineer went out on a strange engine which had the old three-way cock as an engineer's valve, and that was placed in a position different from the valve he had been accustomed to handling. He tried persistently to set the brake the wrong way by letting the air into the train pipe, and he lacked the requisite knowledge of the brake mechanism to perceive what was wrong when the brake failed to hold the train.

Unusual attention has been directed to air brake failures owing to the terrible accident at St. Thomas, Ont., which happened through the failure of the air brake to stop the train. Reliable railroad men who were accustomed to handling air brakes, and who witnessed the accident and helped to push back the cars a few minutes after the accident occurred, assert that there was no air in the auxiliary reservoirs. The most charitable supposition is, that some of the numerous boys belonging to the excursion train turned the air pipe cock on the front car after the brakes were charged at Port Stanley; but the most probable thing is that the brakes were not charged at all, for the auxiliary reservoirs would not have lost all the air in a fast run of ten miles.

If there were any weak link in the mechanism of the automatic air brake which called for strengthening, to prevent the possibility of accidents from failure to act when applied, we would consider it our duty to insist in the most emphatic terms upon the improvement being effected without delay, no matter how elaborate the labor or how great the amount of expense that might be entailed. But we believe that no such defect in the mechanism exists, and that the brake fails only through the carelessness, ignorance, or want of skill on the part of the men handling it, and we consider it our duty to urge railroad companies to do their best to eliminate, or reduce to its lowest possible limit, this source of danger. There are still too many railroads where understanding the brake mechanism is left entirely to the option of trainmen, and on such roads the men as a rule know nothing more respecting the brake than the routine operation of applying and releasing it, and it is roads of this kind that are having nearly all the trouble with brake failures. In our last issue we published a set of instructions on the working of the automatic air brake, prepared for the use of the trainmen of the Northern Pacific Railroad by Mr. George W. Cushing. These instructions apply to nearly every detail relating to the operating of the brake, and there is nothing in them that the average trainman will fail to understand if he makes the effort. If he does not make himself conversant with the action of the different parts of the brake he must go elsewhere for work. Similar rules ought to be in the hands of the trainmen of all roads, and the officers ought to make it their business to see that the rules are understood. The officers of the railroads concerned are the men to blame for ignorance of trainmen respecting important duties. The intelligent man, who does his work understandingly, is the safe man in all walks of life, and this is particularly true with those who handle the increasing intricacies of railroad machinery. On the railroads where intelligence, knowledge and skill are in demand and are encouraged, accidents are of rare occurrence. On roads where ignorance and stupidity meet with favor and fellow feeling from headquarters accidents are numerous. The man who has not the perseverance or energy to study out how a brake works is the man who does his work in a slipshod, perfunctory manner; and he is the kind of individual likely to leave an air pipe cock shut or to forget to couple up an air hose. No matter how perfect the mechanisms may be for operating railroads safely, their successful manipulation must always depend on human care. Where that fails disasters will be sure to happen, and the railroads most likely to escape misfortune are those that are most careful in selecting and training their employés.

The Chatsworth Trestle Disaster.

One of the most terrible accidents known in the annals of railroad operating happened to an excursion train on the Toledo, Peoria & Western Railroad, near Chatsworth, Ill., on the night of August 10. The train, in which there were about 700 passengers, consisted of fifteen cars, six of them being sleepers, and was pulled by two locomotives. About three miles from Chatsworth, at the foot of a descending grade, was a low wooden trestle such as are to be seen by the hundreds on the railroads all over the country. By some means, not shown, this trestle took fire and thereby was so weakened by the time the excursion train came along, that it gave way under the first engine, which however got over with the loss of the tender, and the train engine and the front portion of the train plunged into the hole, making a horrible wreck. Seventy-seven people were killed or so fearfully mutilated that they died within a week, and the maimed and severely wounded are counted by the hundreds.

The Toledo, Peoria & Western appears to be one of the unfortunate roads that was built to pay its projectors rather than because it was needed, and as a result the railroad has nearly constantly been in financial difficulties. The tendency of late legislation has been to make poor roads poorer, and the management of the Toledo, Peoria & Western have had little to spend on improvements; but this has not shielded them from savage attacks by the press on account of the accident, and singularly enough the poverty of the road has drawn brutal reproach. Horrible as it was, the accident was of a kind liable to happen on nearly any railroad in the country, and it was very liable to happen in the West, where long drouth had reduced grass and bridges to the condition of tinder, for nearly all roads have wooden trestles, and hundreds of them have ready kindling beneath them in the shape of withered grass and weeds. The wonder is that accidents of the kind have not been more numerous.

In the June number of the NATIONAL CAR AND LOCOMOTIVE BUILDER we dilated at some length on the dangers of double heading passenger trains, especially where the first locomotive did not control the air brakes. This accident emphasizes the dangerous practice which we earnestly insisted should be stopped. So far as we understand the occurrence of the accident, the train was behind time, and the engineers were doing their best to make up time. They naturally took advantage of descending grades, and were running fast down the descent that led to the scene of the disaster. When he was about 200 feet from the trestle, the engineer of the head engine saw that it was on fire, but he had not the control of the brakes, and he did nothing but shut off steam until the crash came, when he opened the throttle again and pulled his own engine out of the pit. The train dashed into the hole without a brake being set, and to that was no doubt due the fearful telescoping of cars that ensued. Had the engine in front controlled the brakes, and been in charge of a man accustomed to handling the air brake, it would have come as natural for him to apply the brakes when he saw danger ahead as it was for him to shut off steam. Had the whole of the wheels of that train been grasped by the vise-like shoes of the automatic brake for 150 feet before the bridge was reached, it would have made the difference between life and death.

Class Cars in England.

Passenger traffic on British railways appears to be in a transition state, or in other words, it is gradually but surely undergoing a change of base. The first, second and third class discrimination that has so long been adhered to, is rapidly yielding to public necessity, and the result is a slashing inroad upon the conservatism which in many things is a characteristic feature of English railway administration. Statistics that are perfectly reliable show that the proportion of first-class passengers has dwindled since 1850 from 12.1 to 4.2 per cent. of the whole number transported of all classes, also that the seconds have fallen from 39.0 to 8.7 per cent., whilst the thirds have increased from 48.7 to 87.0 per cent. The receipts from the respective classes show also a corresponding change, involving of course a large decrease of revenue. Nor has the end been reached yet, for there is no reason why the stampede from the first and second classes should not go on until the disproportion between them and the third is greater than it is now.

The truth of the matter appears to be that the patrons of first and second-class cars, under the existing scale of fares, are beginning to realize that they do not get the worth of their money. There is no difference to speak of in the cost of hauling the cars. The only difference is in the style of accommodations and the original cost of the vehicles. A first-class carriage costs on an average 22 per cent. and a second-class 11 per cent. more than a third-class one, yet a first class fare is, as a rule, 117 per cent. more than a third, and a second-class 60 per cent. more, and, by way of encouraging the stampede, the third-class accommodation is being gradually improved, whilst there is no improvement in that of the first and second. Evidently something must be done to equalize things, or one of the cherished institutions of the realm, guaranteed by magna

charta, will be in danger of extinction. The writer of a pamphlet recently published in London discusses the subject very intelligently, and suggests a plan by which the tide may be turned in favor of the first and second class cars, so as to check the ebb and restore the profits. He proposes to divide the service on all the lines into slow and fast trains, the fast trains consisting of firsts and seconds only, and the slow trains of firsts and thirds only, the fares per mile to be as follows:

1st class, fast trains	1¼ Penny.
1st class, slow trains	1½ "
2d class, fast trains	1½ "
3d class, slow trains	1 "

This scheme looks very well on its face if we assume that all the lines would agree to it and abide by it; and furthermore, that the public would be satisfied with it. Human nature on the other side of the Atlantic is not essentially diff-rent from what it is on this side. Here in the United States, first-class people—people who are well-to-do, as the phrase goes, pay high rents, wear good clothes and keep a carriage—would not care to travel in a slow train to save ½ of a cent a mile, especially if such train were liable to be switched on a siding to allow a fast train to pass full of second-class passengers who are a round or two lower on the ladder of thrift and respectability. Fine cars would not as a rule compensate for slow speed, nor fast speed for inferior cars; and not a few people who would not scruple about riding in a third-class car, would object to an aggravation of misery by the addition of slow speed.

Where Smoke Consumers are Wanted.

There is going to be a demand directly for smoke consumers for the switching locomotives operating within the city limits of Chicago. Since Pittsburgh began to put on airs of cleanliness through the extensive use of natural gas as fuel, Chicago has been rapidly looming up as the dirtiest and worst smoke-begrimed city in the Union; and the switching locomotives contribute an important share of the smoke that constantly hangs like a pall over the city. The health authorities have concluded that raising smoke is more a luxury of carelessness than a necessity of ordinary combustion; and the officers of that department have begun to stir up the roads whose locomotives are the worst transgressors of the law prohibiting smoke. The Baltimore & Ohio and the Michigan Central people have already been notified that their smoke is too dense and too profuse, and other companies will receive similar notices before this sheet reaches the printer.

It is a hard matter burning some kinds of Western bituminous coal without smoke, but a great proportion of the smoke from locomotives that residents of cities have to complain of is caused by gross carelessness in firing. The locomotives belonging to some roads in and around Chicago are noted for the dense and incessant volumes of smoke constantly poured from the smoke-stack, while the locomotives of other roads, again, are just as well known and as noteworthy for the small amount of trouble they give with smoke. On the roads where firemen are controlled and instructed to fire properly, there is little smoke; on the roads where the firemen are permitted to throw coal into the fire-boxes any way they choose, and the officers pay no attention to such details of operating, the engines are a nuisance by the smoke they cause.

Very little expense need be incurred to fit up a first class smoke preventing device on a locomotive. Three or four 2-inch holes made in the front of the fire-box three or four inches above the ordinary level of the fire, and a good brick arch are all that is needed. If these are put in and the engine still causes smoke the trouble is with the fireman. Let him understand that he must keep down the smoke, and there will not be much cause for a notice from the health officers. Smoke consumers are like many other railroad appliances, they work well when attended to, but they cannot dispense with human intelligence, or defy human stupidity.

The Cost of English Railroads.

It has been a matter of surprise with many people that the reputed cost of railroads in Great Britain should be nearly four times as much per mile as the average cost of railroads in the United States. An elaborate article which recently appeared in the "Railway Engineer" (London) throws some light on the problem. The writer states that up to the end of 1884, the average cost of all the railroads in the United Kingdom (reducing his figures to dollars) was in round numbers $207,000 per mile, while the cost of all the roads in the United States at the end of 1885 was in round numbers $55,000 per mile, making no account in either case of watered stock. Assuming that the proportion of this kind of stock as a cost basis is approximately the same in both countries, there is still an enormous difference to be accounted for, and if this difference is really what is shown by the figures, its bearing upon the percentage of earnings and rates of transportation is quite an important matter, the capital basis of English roads being nearly four times as large as that of the roads in this country.

In extenuation of their excessive cost, it should be remembered that the English lines are limited to a small area of densely populated territory as compared with ours, and it is obvious that their greater cost is due, to a considerable extent, to the difference in the value of land in the two countries. More than fifty per cent. of these lines are double, and some of them treble and quadruple, and the proportion of sidings is also much larger than in other countries. The superior excellence and stability of the permanent way is a factor which should also have its due weight in accounting for the cost. On the other hand, a large proportion of the railroads of the United States are single tracks, cheaply built, with an enormous aggregate mileage extending over an immense and sparsely populated teeritory, the cost of construction in many cases being greatly reduced by land grants and other concessions in various ways. This, in a general way, accounts for much of the difference in the cost of the roads in the two countries.

But it appears from the article in the above named paper that there is another element which enters largely into the cost of English roads, and which goes by the name of "parliamentary expenses," or in other words parliamentary battles over railway bills. The expenditure in this kind of warfare, as officially reported, amounted to about $20 000,000 between 1872 and 1882, or 2 per cent. of the total addition to capital expenditure in ten years. From this very significant item some idea may be formed of the entire outlay on this score, and its effect in augmenting the cost of the roads. Other instances of the wasteful diversion of capital are given by the writer, but we will only refer to the case of one road, one-quarter of the capital of which was "dissipated" in obtaining the rest of it from the public, and nearly one-sixth of what remained was "disbursed" in the payment of interest and dividends.

There are other things in the article which invite comment, but our present purpose is merely to dispense a little light from an English point of view, and upon what seems to be trustworthy authority, upon the almost fabulous cost of English railroads as compared with that of our own. There has been corruption, dishonesty, sharp practice and trickery enough in railroad construction and management in this country, but it can not justly be said that we make a monopoly of that kind of thing.

Horses and Electricity.

It is a widely accepted truth that where there is a good deal of smoke there must be some fire. Applying this axiom to what is said in the newspapers about the propulsion of street cars by electricity, it would really seem that the fire is nearly ready to burst out. In the rapidly growing and densely populated cities of New York and Brooklyn the cruelly overtaxed horse equipment of the street car lines is fast becoming an eye-sore. The cable system has been introduced just enough to be appreciable, and show what might be done if somebody would do it. A few weeks ago the Julien electric motor performed some wonderful experimental feats on the Fourth avenue line, pulling a car full of passengers at the rate of 12 and even 15 miles an hour, the motor being all the time "under the most perfect control, stopping and starting with the greatest precision and ease, and running steadily either slow or fast along intricate switches and curves." In fact, it beat the horses all to pieces, and, according to current report, "nearly all the officials of the surface line roads became interested in it," mainly for the reason that it could be run at a cost of $4.10 a day a distance of 90 miles with a car crowded with passengers, while the average cost of the same service with horses would be $7.50 a day. We have not the means for verifying these figures but give them as we find them. In addition to this, we have the most tantalizing reports from other parts of the country. In Montgomery, Ala., electricity is said to be in use on 11 miles of road, and the cost is reported by the general manager to be only one-half the cost of horse-power. Tracks have been laid for a cross-town cable electric railway in New York, to be operated on the Bentley-Knight system, and the cars, it is said, will be ready in September. This project, in connection with the experiments with the Julien storage battery system above noted, is significant of a change in this great metropolitan stronghold of horse-car conservatism. Nothing, however, may come of it, after all. But it is well enough to place the movements on record. The world, as every body knows, can not be reformed in a day, but if the horse-car nuisance is ever to be reformed out of existence, the cities of New York and Brooklyn are good places in which to make a beginning.

The Anti-Magnetic Watch Shield.

We understand there is widespread discontent and in many cases indignation among the trainmen on different roads owing to orders having been issued from headquarters requiring all engineers and conductors to have what is called an anti-magnetic shield put upon their watches. The belief is very general among the men that this shield as a protection for their watches is a humbug gotten up for the purpose of obtaining money without giving an equivalent. There has been a committee appointed by the Master Mechanics' Association to investigate the subject of the "Magnetic Influence of Iron and Steel in Locomotives on the Watches of Engine Runners," which we presume to be in some way connected with the claims of those who say that the anti-magnetic shield is necessary. There is no question but the committee appointed will investigate the subject thoroughly without heeding claims that are not fairly substantiated, and it would be a good plan for railroad managers to delay action in compelling trainmen to purchase an article of doubtful utility until the investigating committee can be heard from. Watches have got along very well for a great many years without any anti-magnetic shield, and there will not be much danger in letting them go along for a few months longer in the same way. Railroad managers can not be too careful in keeping clear of entanglements that would lead to the reproach that they had even in an innocent way lent themselves to schemes for making money out of the employés under their charge. We have carried a good many different watches on locomotives, but we never could see that a poor watch acted any differently there than it did when we were away from iron and steel influences, and a good watch kept time as well on a locomotive as in a house. We believe the pretence that the iron and steel in locomotives influence the regularity or reliability of watches to be without foundation, and that the influence is all in the brains of the men seeking to make money by the pretence. There is a great deal more iron and steel in the complex machinery of a large steamer, and the pretension was never raised that they influenced the action of chronometers, for if they did it was certain to be discovered long ago. If the anti-magnetic shield will make a poor watch keep good time, we can see some reason for advocating it. It certainly can do no good to a first-class watch that can be depended to vary less than a minute in a month, and there are many watches reliable to that extent.

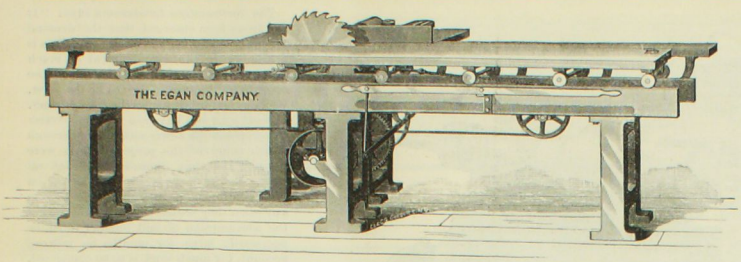
Business for Scale Makers.

The subject of charging for the transportation of live stock on the sensible basis of weight is again occupying the attention of Western railroads, and the roads running into Chicago are in the way of putting the matter into practical shape. There has been a great deal of talk about the subject for a month, but little real gook has been done. The companies having the largest stock cars have continued to get the lion's share of the stock carrying business, and the practice of increasing the size of stock cars has kept going on till there are now cars of that kind 36 feet long. When one car was considered of exactly the same value as another car, no matter how great the difference in size, it was not to be expected that the road with many cars 28 feet long was going to get a fair share of the business, while competing with a road that had cars 34 feet long and over. For local business the smaller cars were often large enough, and the practice of increasing the size of cars to 35 feet was not necessary except to give one road the advantage over its competitors.

Lately, the live stock committee for the Chicago terminal lines, after fully considering the subject of weighing stock, decided to purchase track scales and put them in as quickly as possible, so that all stock coming into Chicago may be weighed without inconvenience. Two sets of scales will be located in the stock yards, on which the live stock arriving by the Eastern Illinois, Wabash, and Louisville, New Albany & Chicago roads will be weighed. The Rock Island will have scales on its tracks between Forty-first and Forty-seventh streets. The Illinois Central, Baltimore & Ohio and probably the Michigan Central will do their weighing on scales to be put in by the Illinois Central near the shore of the lake. The Alton will erect scales at Brighton, near the connection with the stock yards tracks. The Burlington will have scales near the crossing with the Pan-Handle. The Milwaukee & St. Paul, Northwestern, Wisconsin Central and Minnesota & Northwestern expect to have scales put in for them by the Stock Yards Company near Ogden avenue.

We have heard quite a number of master car-builders speak favorably of Mr. William Forsyth for Secretary of the Master Car-Builders' Association, in place of Mr. Forney, who has resigned. Mr. Forsyth would be a very good man for the position. He is a practical railroad man whose views on all car matters are considered well worthy of consideration, and he possesses all the literary ability required to edit the annual report successfully.

The National Car and Locomotive Builder Supplement for the current year has just been issued in the usual form. It is mainly devoted to advertisements, which represent an extensive variety of railroad appliances, including tools, equipments and general supplies, and to which easy reference is made by means of a classified index. It also contains revised directories of car and locomotive builders, car wheel, axle and spring manufacturers, and a complete list of street railroad companies in the United States, Canada, Mexico, Central America and South America. A copy is sent gratuitously to every person whose name appears in it, and also to all railway officials in the United States and Canada. Prepared and issued by John N. Reynolds, 140 Nassau street, New York.



SELF-FEEDING CARRIAGE EDGING SAW *(With Improved Rope Feed.)*

The engraving represents a new self-feeding Carriage Edger, manufactured by the Egan Company, Cincinnati, O., and designed for edging up stuff accurately and rapidly, especially where parties need a machine that will stand up to heavy work. The frame and ways are of iron planed perfectly true. The table is of wood and is built up and placed upon rollers and brackets. The carriage is fed forward by the movement of a lever which puts in motion a drum carrying a rope to which carriage is also attached. The carriage is reversed by a reverse motion of the lever; it is fed back at a very rapid speed at about the rate of three to one forward. The lever will be found convenient to operator at any place he stands. The company's patent friction device for feeding forward and reversing the motion of the carriage is the most complete, perfect and durable ever put on a machine of this class. There is no possibility of its getting out of order, and it is made on the most scientific principles to prevent any possible wear. When desired the machine will be furnished with carriage to move by hand power, thus making a first-class machine for hand edging. Five sizes of the machine are made, 12, 14, 16, 18 and 20 feet in length, and any special length can be made to order. Each machine is furnished with a patent expansion extra heavy saw mandrel, and an adjustable fence moving in a dovetailed groove.

Further information and prices may be obtained by addressing the manufacturers as above.

Railroad Annoyances.

Railroads have made Chicago the great prosperous city which it is, but the railroads inflict much discomfort and misery in connection with their advantages and benefits. All the roads cross the streets on the level and they penetrate every where within the city limits. The trains run through unprotected streets kill and maim a deplorable number of people annually. There appears to be no restriction to the quantities of cinders, dirt and smoke poured out by the locomotives, all of which is borne with long suffering patience. One nuisance has become too exasperating for the good nature of even Chicago people, and that is the incessant whistling and bell ringing that goes on day and night. They have determined to try and abate this nuisance if possible. Respecting the existing state of affairs, a city paper says:

Not only in the city, but in some of the suburbs through which numerous trains pass on their way into and out of Chicago, the screaming of locomotive whistles is far in excess of all necessity or excuse. The whistles on many of the engines are of the most aggravated character, and their unearthly screeching is enough to raise the hair on a Comanche Indian. When the collapsed citizen is tossing on his bed at midnight in the vain effort to sleep, and these trains come tearing by, screaming at every crossing, he feels that a "palsy" speech from General Fairchild, or some higher power that would silence them for ever, would be more blessed than a fall of 20 degrees in the thermometer. What possible need there can be for such crazy whistling in the nighttime, when people are all abed, is beyond conjecture.

It is probable that the practice has simply become habitual on the part of engineers, and has run to outrageous excess merely because of the tolerance of the public. To the extent that it is not needed and serves no good purpose, the whistling and bell-ringing nuisance should be abated.

The Inordinate Use of Sand.

In the course of the discussion at the last Master Mechanics' Convention on the influence the engineer has to prevent wear of tires, some important points were made against the indiscriminate use of sand as a means of preventing slipping, and some of the members argued that since sand was injurious to rails and tires, traction increasers must necessarily be a good thing. We can not see how one thing being very bad makes another bad thing any better. Although sanded rails accelerate the wear of rail and tire, it certainly does not cause so much injury to either as slipping, and the fair argument against sand is in its profuse and unnecessary use, of which there are plenty of examples to be seen daily on nearly every road in the country. If greater care were taken to keep the rails dry, there would be less call for sand or traction increasers. In watching engines pulling out on roads where slipping is often inordinate, we have observed drips from cylinder cocks and water pipes falling direct upon the rails and thereby bringing about the very worst condition for adhesion. Drain cocks of injector pipes are often set directly above the rail, and when they begin to leak, as they always do sooner or later, they wet the rail. There is no necessity for locating the cylinder cocks directly above the rail, although it is done in many cases, and in starting the water of condensation, with no doubt a small percentage of oil, drops directly on the rail and heavy sanding is needed to preventing slipping. We believe that time and attention devoted to preventing the wetting of rails by dropping of water and oil from the locomotive would bring a better saving in preventing wear of tires and rail than any thing that could be done by traction increasers. While this cause of slipping is at work, there is certain to be large quantities of sand poured on the rails, no matter what weight may be placed upon the drivers.

Chicago & Northwestern Rolling Stock.

During the last year the Chicago & Northwestern Railway Company operated 4,037 miles of track, and in doing the work used 735 locomotives and 23,156 cars. Of the latter 266 are first-class passenger cars, 11 are parlor cars, 9 are dining cars, 28 are second-class passenger cars, 48 are combination cars, 112 are baggage and express cars, 26 are mail cars, 7 are paymasters' and officers' cars, 405 are caboose cars, 22 are milk cars, 18 are boarding cars for workmen, 12,434 are box freight cars, 117 are refrigerator cars, 1,450 are gondola cars, 2,197 are platform cars, 1,914 are live stock cars, 25 are dump cars, 82 are ditching cars, 3,957 are iron ore cars, 28 are pile driving and wrecking cars.

It cost $947,771 to maintain the locomotives in working order, or $1,289 per engine. The maintenance of passenger cars cost $370,028, or $730 per car, and the maintenance of freight cars amounted to $894,489, or $40 per car. Of the locomotive repair account 59 per cent. went in payment of labor, yet this does not represent nearly the total cost of labor for many articles such as injectors, lubricators, head lights, brakes, etc., that were put on the engines were bought finished. Of the passenger cars repair account 63 per cent. was paid to labor, and much of the car equipment was bought ready to put on. Of the repairs on freight cars 47 per cent. was paid to labor. During the year there were 524 tons of links and pins used costing $24,104, an item that has an important bearing on the future car coupler.

The mileage made by all the locomotives was 25,483,938 miles, being 2,912,611 miles, or 11 per cent. more than was run the year before, and making close on 35,000 miles for each locomotive owned by the company. The work was done at a cost of 17.49 cents per mile, that giving for repairs 3.72 cents, wages of enginemen and wipers 6.94 cents, fuel 6.35 cents, oil waste, and tallow .47 cent.

Car Couplers on the C., B. & Q.

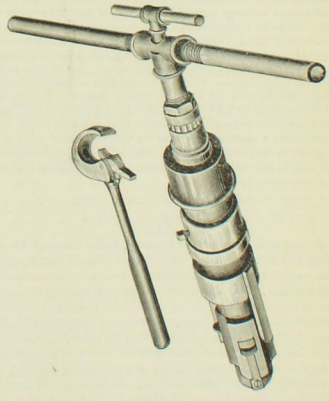
In considering the question of what style of automatic car coupler was likely to be most suitable under all conditions of service, the Chicago, Burlington & Quincy officers after very careful investigation decided that an important feature about such a coupler was that it should couple with the Miller hook used on passenger cars. The practice of running a car or two of fast freight in passenger trains is increasing, and it was felt that no coupling would be satisfactory that did not connect easily with passenger car couplings. The company intended equipping fifty of their freight cars with the Cowell coupler, putting them into ordinary service, and waiting for developments, much in the same way as they have done with couplers of the Janney type. But when they were almost ready to begin putting on the couplers, it was discovered that the Cowell did not couple with the Miller hook. The railroad company at once drew back, and orders were issued that the Cowell coupler should not be applied until the manufacturers constructed it so that it could be used to couple directly with the Miller hook. We understand the Cowell Company say that this can be done easily, and that they have proceeded to alter their patterns to make the coupler connect with the Miller hook. It is rather singular that a company like the Cowell should have introduced their coupler to the extent they have done, without providing for its coupling with the hook used on so many passenger cars; but it appears that they did not think the matter was of any importance until it was raised into prominence by the action of the C., B. & Q. people.

Master Mechanics' Report.

The report of the proceedings of the twentieth convention of the American Railway Master Mechanics Association has been published. We believe the report corroborates the opinion we have already expressed that the convention held at St. Paul was one of the most valuable meetings ever held by the association. Most of the reports of investigating committees were much beyond the average of such reports in the succinct form in which they were presented and also in the valuable facts collected. Now that it can be read and examined along with its illustrations, the report on "Methods of Coaling Locomotives" will be admitted to be one of the most valuable papers submitted to the association, and several of the others are not far behind it. The discussions on the "Extension Smoke-Box," "Proportion of Locomotive Cylinders," "Pressure of Steam," and on the "Use of Cylinder Oil" are long and interesting. The report is illustrated by twenty-three cuts, all of them having been got on single pages so that no folded leaves are necessary. The report ought to be in the hands of every railroad man interested in mechanical matters, for it contains valuable information in well digested form. The report may be obtained from the secretary or from any of the railroad papers for $1.50.

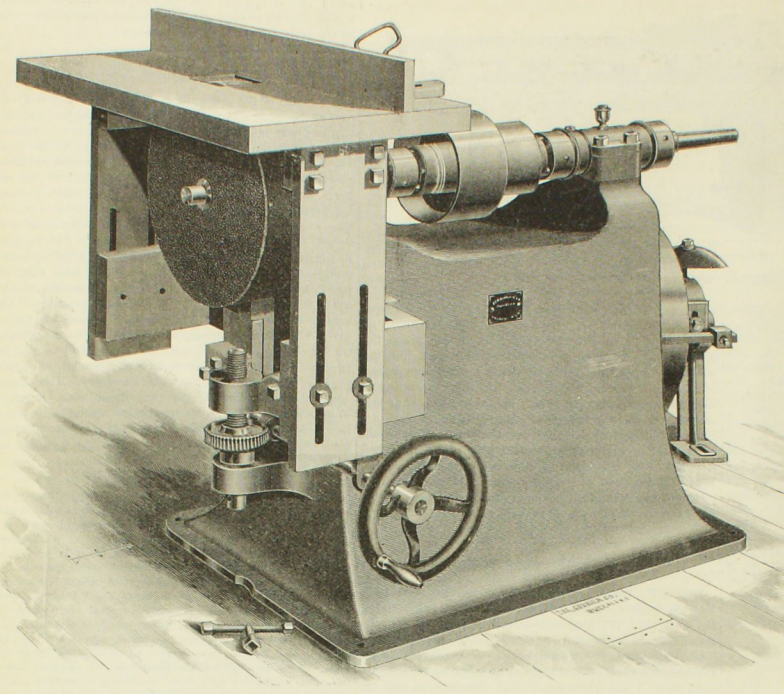
Poor's Directory of Railway Officials.—This publication for 1887 (the second annual number) has just been issued. It contains very complete and admirably arranged lists of steam and street railroad officials corrected up to the time of publication; also lists of car and locomotive builders, car axle, wheel and spring manufacturers, railroad contractors, bridge builders, and rail mills. In addition to the general list of railroads, which for convenience is made to conform to that of the "Manual," there are special lists of general managers, general superintendents, freight and passenger agents, master mechanics, master car-builders, master car painters, purchasing agents, and chief engineers. The volume also contains an alphabetical list of the names of all the officials in the general list, by means of which the road with which each name is officially connected can be readily referred to. The railroad commissioners of the several States, officers of sleeping and parlor car companies, and a list of Mexican and Central and South American railroads, are also given. The "Directory" is intended to be supplemental to the "Manual," and contains a vast amount of information which can not be given in the larger publication without increasing its size to unwieldly dimensions. It should be noted that in one respect the present number of the Directory is a great improvement upon that of last year—it opens sideways like an ordinary book, instead of endways.

Baughman's Patent Boiler Tube Cutter.



This handy little tool is designed for cutting off old tubes for safe ending, inside the tube sheet, and for removal and cutting off the ends of tubes to proper length after they have been placed in the boiler and expanded at one end. This effects a great saving in time, and avoids the danger of splitting the tube, as often occurs when the chisel is used. It dispenses with all marking and taking out tubes after they have been put in the boiler and marked to cut to length, as is generally done with locomotive tubes. With this cutter it is only necessary to put them in once, expand in fire-box and cut to length. It makes no difference how uneven the tube sheet may be, the cutting is gauged from the tube sheet, and the ends will all be an equal distance from it. There is nothing about this cutter to wear out easily or get out of order. The tool is made of steel and hardened. It has three revolving cutters that cut from the inside of tube. While cutting, the bearing is all on these wheel cutters and none on the stock. It works easily and rapidly. The cutters are very inexpensive to replace; 300 2-inch tubes have been taken out in ten hours at the Atlanta shops of the Richmond & Danville Railroad Co. Different sizes are built for the various sizes of boiler tubes.

Manufactured by Pedrick & Ayer, proprietors of the L. B. Flanders Machine Works, Philadelphia, Pa.



EMERY WHEEL SURFACER.

The engraving represents an emery wheel surfacing machine, made by the Springfield Glue and Emery Wheel Co., Springfield, Mass. It will be recognized as a substantial machine for the purpose. The base is not only heavy, but it has sufficient flare to give a solid floor foundation, which prevents vibration when being used. One end of the machine has a table 30 inches long by 15 inches wide, with an adjustable side guide for sliding work over the wheel. The ends of the table have perpendicular supports extending downward, each with two slots through which bolts pass to securely hold the table when set, and prevent its springing under heavy weights. The table is raised or lowered by a screw worked by a worm and worm gear (or bevel gears) and is kept in line by having side guides running over a dovetailed track on the end of the base. The opposite end of the machine is left open for miscellaneous work. The machine is used with solid emery wheels or wood covered wheels, with the ends of the spindle tapering to hold the wheels on by friction or with tight and loose collar and nut; the spindles are made both ways. The machine has a steel spindle long enough for a man to work at each end at the same time; the spindle is two inches in diameter and runs in self-oiling, composition-lined boxes, eight inches long, of approved design.

Annual Scarcity of Cars.

During half of each year or more, every railroad in the West and Northwest has long rows of freight cars standing idle on side tracks wearing themselves out by exposure to the weather. But when the season for moving the crops comes round, if the general movement is not restricted by the speculations of the grain market, all the cars are called into service and they fall, often very far short, to supply the demand. If a shipper loads only one car a year, and then wants it at a time when all the shippers along the line are screaming to be supplied with cars, he feels himself morally aggrieved unless the car is forthcoming without one hour's delay. In years gone by the urgent demand for cars and the consequent scarcity came round annually, and the railroad companies did the best they could for their customers and got the various shippers to wait patiently till they could be supplied, but this season a new complication has arisen on the scarcity of car question. The working of the Inter-state law and the ready appeals to the Commissioners for the settlement of questions that never ought to go beyond the railroad agent, is educating shippers to fight railroad companies through the Commissioners on every trifling dispute that arises. The scarcity of cars has this year led to many appeals to the Commissioners to compel railroad companies to supply cars more promptly than they have been able to do. Any interference in cases of this kind is certain to have a pernicious influence in the long run on the shipping interests. If pressure is put upon railroad companies to build more cars, so that a greater proportion must stand idle during the greater part of the year, the shippers must eventually pay the interest on the money invested.

The Pennsylvania Railroad Co. has adopted a new rail section designated as "No. 6 Standard," and the rolls for the new rail are now being made. The height of the rail is 5 inches, and its weight per yard 85 pounds. The increase in weight is not the only noticeable feature of the new pattern. The corner radius is reduced from $\frac{5}{8}$ in. to $\frac{1}{16}$ in., and consequently does not correspond with the standard curve of flange fillet adopted a year ago by the Car-Builders' Association. This standard is $\frac{5}{8}$ in., and was adopted on the theory that the corner of the rail should correspond inversely to the throat of the flange, in order to reduce the flange wear to a minimum. Evidently there is something wrong either in the theory or in the Pennsylvania practice. We always thought the theory was a little obscure, and now it seems more so than ever.

VALVOLINE OIL has long been known as the cheapest and best oil in the market for the cylinders of locomotives. As compared with the black mineral oils that are so extensively used, it shows a great saving in the wear of valves and seats, its superiority being due to the expensive process by which it is refined, a process which requires the use of some thirty tons of bone-black per month to filter and cleanse it from the earthy matter, grit and bitumen) which is always found in the black cylinder oils that are in use on some of the best railways. It is manufactured by LEONARD & ELLIS, at their works at Edgewater, N. J., which are the most extensive of their kind in the country. This firm has been engaged in the manufacture of cylinder and valve oils for twenty years, and were the first to introduce mineral oil as a substitute for tallow in steam cylinders. They guarantee that their Valvoline Oil will case-harden and will preserve the metal, and furnish more lubrication for the money than any other oil, a fact that is confirmed by the testimony of numerous master mechanics.

THE UNION INDURATED FIBER CO., 110 Chambers street, New York, have just broken ground at their Lockport factory for the erection of a stone building, to be used for a treating and finishing house. Their new dry-house at the same place is nearly completed, and their new 100 horse-power boiler is provided with the latest improvements for economizing fuel. The summer season has shown no falling off in the demand for their goods, and their mills are running night and day to their utmost capacity.

The office of Mr. Charles B. Miller, manufacturer of Anti-Friction Metal and Camelia Brass Journal Bearings, has been removed from 541 West 32d street to 102 Chambers street, New York. His factory has been removed to 44 to 50 Jay street. Mr. Miller has shown us some flattering testimonials from leading railroads in favor of the products of his manufacture.

THE THAYER MANUFACTURING CO., of Milwaukee, have largely increased their working capital, also their plant and capacity, and can turn out 3,000 car bearings per day of eight hours. Additional capital can be employed if needed, and the product doubled should the business require it.

The *Northwestern Lumberman* says: "It has lately been observed that the demand for railroad timber has fallen off. This is attributed to the abandonment of much projected construction, on account of the severe and protracted drouth in the West, which is certain to curtail the corn product. A short corn and hay crop will impoverish the people in the newer settlements through which many of the projected lines were to run, and thus diminish traffic of all sorts. Railroad managers have an eye on such contingencies, and are apt to take in sail when they see the squall coming. Yet the consumption of mill product must be necessarily large for months on railroad account, for much work is to be completed. The late diminishment of demand can also, to a certain extent, be attributed to the fulfillment of contracts made early in the year. The movement of the spring and summer has anticipated the requirement for some time in the future."

In reference to the timber supply of the country, the Boston *Bulletin* says: "Notwithstanding the great draw upon the wood reserves of the country there is no danger of exhaustion at present. New England is by no means denuded of its timber. The great Northwestern pineries are comparatively unexhausted. There is also a vigorous second growth of white pine in New England, where the forests are already yielding between 200,000,000 and 300,000,000 feet of timber annually. Southern pine, although stripped from the banks of streams flowing into the Atlantic, is practically untouched in the Gulf States, especially those bordering on the Mississippi. The hardwood forests of the Mississippi basin are still prolific. In Michigan, particularly the Northern Peninsula, hard wood is plentiful, maple especially. In the Pacific coast region the great forests of fir are practically intact. The forest capacity of the country is vast. Strange to say, the decimating element of most potence is fire, and not the axes of mercenary timber speculators."

Wm. J. Murphy, who has been appointed General Superintendent of the New York, Lake Erie & Western in place of Benj. Thomas, resigned, is not yet 40 years old, but he has been in the service of the company since 1862, when he was a messenger boy at Susquehanna. He soon became a telegraph operator, and from that time his advance has been steady.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any errors that may be noticed in our list:

Atchison, Topeka & Santa Fe.—H. M. Ferry has resigned his position as Master Car-Builder to accept that of Superintendent of Repairs at the Pullman Co.'s shops, at Pullman, Ill.

Baltimore & Ohio.—J. Van Smith has been appointed superintendent of the Philadelphia Division vice Wilbert Irwin, resigned. T. Tresize has been appointed Master Mechanic of the Philadelphia Division.

Chicago, Santa Fe & California.—John Hodge has resigned the position of Master Car-Builder to accept a similar one on the Atchison, Topeka & Santa Fe.

Chicago, St. Paul, Minneapolis & Omaha.—Mr. J. M. Whitman, General Superintendent, having resigned, the duties of the office will be performed by General Manager E. W. Winter.

Chicago & Northwestern.—John M. Whitman has been appointed General Manager, vice M. Hughitt. Sherburn Sanborn has been appointed General Superintendent, in place of C. C. Wheeler, resigned. M. Hopkins is Superintendent of Iowa Division, vice H. G. Burt, transferred, and G. F. Bidwell, Superintendent of Northern Iowa Division, vice M. Hopkins, transferred. Wm. McIntosh, Master Mechanic of Dakota Division, has had his jurisdiction extended over all the lines of the road between Winona and the Mississippi River.

Natchez, Jackson & Columbus.—H. Wilkins has been appointed Master Car-Builder, vice G. Enders, deceased.

New York, Lake Erie & Western.—William J. Murphy, Superintendent of the Buffalo and Rochester Divisions, has been appointed General Superintendent, in place of B. Thomas, resigned. E. Van Etten has been transferred from the superintendency of the Delaware Division to that of the Buffalo Division, and W. H. Starr has been transferred from the Rochester to the Delaware Division. G. A. Thompson, Roadmaster of the Western Division, has been made Superintendent of the Rochester Division.

Ohio & Northwestern.—H. B. Kahmer has resigned as Master Car-Builder of this road.

Panama.—J. E. Reeves has been appointed General Superintendent, vice Frank G. Ward, resigned.

Toledo, St. Louis & Kansas City.—W. H. Pettibone has resigned his position as Superintendent.

Union Pacific.—F. Mertzheimer has been appointed Master Mechanic of the Kansas Division, vice J. O. Chapman; and Samuel Eagan Master Mechanic of the Colorado Division, vice R. McDougall.